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Electronics in Motion and Conversion

January 2018



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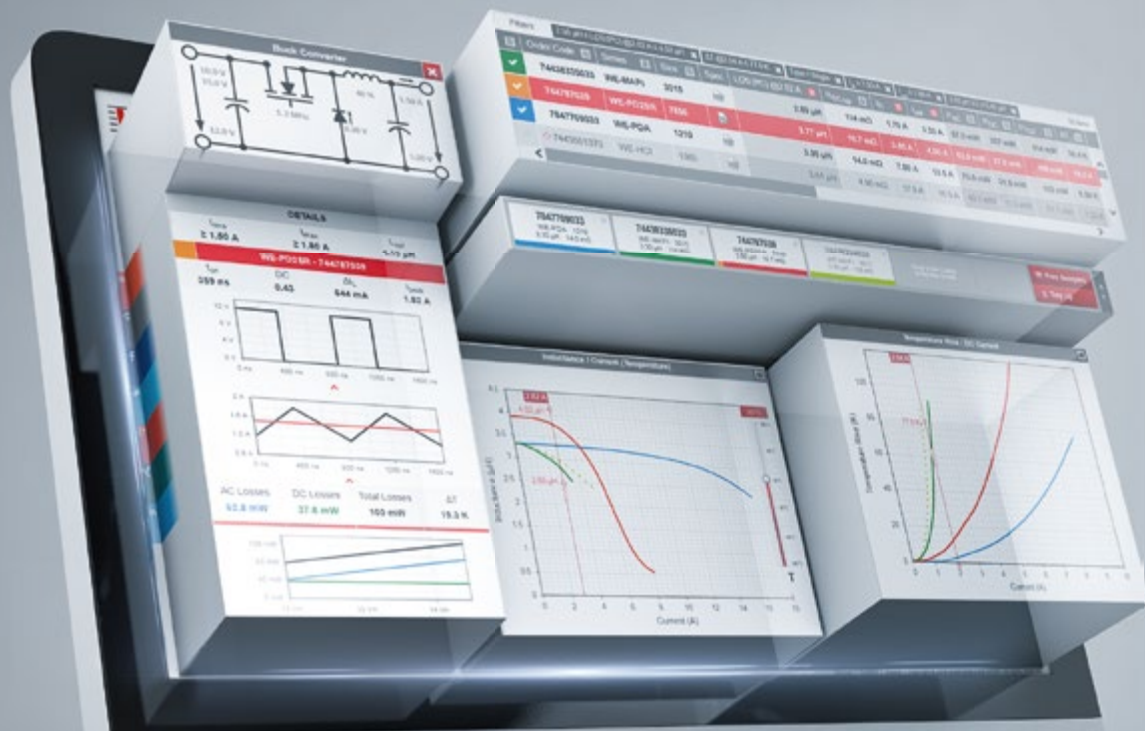
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Events
NEPCON 2018

Tokyo, Japan, January 17-19
www.nepconjapan.jp/en

IEW 2018

Bengalore, India, February 7-9
www.indiaelectronicsweek.com

EMC 2018

Düsseldorf, Germany, February 20-22
www.mesago.de/en/EMV/home.htm

APEX 2018

San Diego CA, USA, Feb 24 – Mar 01
www.ipcapexexpo.org

Embedded world 2018

Nuremberg, Germany, Feb 27- Mar 1
www.embedded-world.de/en

A New Year, With Challenges As Ever

In the circle of our beloved, the festive mood of Christmas is still close to our memories. For most of us, mountains of delicious food and gifts abounding, accompanied these special days. During these festive hours it is only human not to remember all the people on this planet who are not so blessed ! I too fall into this trap ! But still, I think it's important not to treat our privileges as self-evident.

Bodo is just recovering from a severe case of Bronchitis, but in the February issue he will continue to share his observations on our Industry and no doubt discuss some socially critical issues.

The New Year, 2018, has dawned and brings a lot of good intentions to many of us - like many a year in the past, no doubt. We all have good intentions: living healthier, exercising more and looking after oneself - just a few of the goals people set for themselves. After Bodo recovers, he too will join in our plans to live a more healthy life. Bodo has already seen a personal goal realized ! It was a really good feeling for him to know that the work in our family business continues, even though he had to allow himself a few days' rest. Working with people whom you can trust unconditionally and who are just as motivated as you – priceless !

The year 2017 was again a very successful one for the Magazine. It ended with the Power Conference in Munich, and this event, carried out in cooperation with our friends from ICC Media, was also a success. Hundreds of attendees enjoyed the expertise of selected representatives on the subject of Wide Band Gap semiconductors. The transition to SiC and GaN will be keeping us busy for a long time. These materials are an indispensable part of the future of power semiconductors. Again, a big thank you to all sponsors, speakers and participants !

The Conference season in 2018 will start soon and we will be present at all important events. APEC in March in historic San Antonio (in Spanish Tejas), then PCIM Europe in June – remember the new date. You will always find a list of important events on our website and in the magazine. As I strolled through the endless halls of productronica



in November, however, I wondered about the size, the glitter, and cost of the displays. Isn't a Conference really about conveying information – just my point of view...

Again in 2018, Bodo's Power Systems will be appearing every month and reaching its readers worldwide. We will continue to rely on a printed magazine. At a time when online pop-ups are overflowing in the web and our emails spill over daily, it is a good thing to retire with a magazine and enjoy relevant topics in peace. Our readers provide us this feedback almost every day.

Peaceful contemplation - maybe another worthwhile intention.

Bodo's Power Systems reaches readers across the globe. If you are using any kind of tablet or smart phone, you will find all of our content on our partner-website www.eepower.com or visit us on Twitter, LinkedIn or Facebook. If you speak the language, or just want to have a look, don't miss our Chinese version: www.bodospowerchina.com.

My Green Power Tip for January:

Concentrate on the essential at your trade fair appearance. For Vendors, transporting tons of material to the venue is not ecological. Information transfer may get lost in the spectacle of the stand. Sometimes a little less is more !

Best regards

Accurately everywhere

E-World
2018 Essen
Stand 6-211



LXS, LXSR, LES, LESR, LKSR, LPSR series

New closed-loop current transducers, based on a custom Hall Effect LEM ASIC, perform at the level of fluxgate transducers, achieving the highest levels of quality and traceability using advanced manufacturing techniques. Offset drift is over four times lower than the previous generation of closed-loop transducers based on Hall cells and very similar to those using fluxgate.

There are 6 families and 22 models available with various options, such as an integrated reference (V_{REF}), footprint (3 or 4 primary pins with different layouts), with an aperture and/or with integrated primary conductors and overcurrent detection.

- 1.5 to 50 A nominal current
- PCB mounting
- Low offset drift (4 – 14 ppm/°C)
- Overcurrent detection output (LPSR models)
- -40 to +105°C operation
- 100 % compatible with previous LEM generation
- Multi-range configuration

New Product Brand Name Dowsil

Dow Performance Silicones announces the rollout of a new product brand name DOWSIL™ for its heritage Dow Corning high-performance silicone-based building products. The new DOWSIL™ product brand name represents the combined power of Dow and Dow Corning and emphasizes longstanding global expertise in silicone technologies across dozens of industries. Dow Corning revolutionized the way architects and fabricators design commercial façades, with 50+ years of proven performance in Silicone Structural Glazing (SSG) and Weatherproofing Sealants (WP). Customers can continue to rely on the same trusted silicone chemistries, features and product benefits for their designs under the new DOWSIL™ name. “As we transition to the DOWSIL™ brand name, which blends the collective experience of

long-standing, respected organizations, our performance stands and our commitment remains,” said Jean Paul Hautekeer, Global Strategic Market Director – High Performance Building, Dow Performance Silicones. “We value our customers’ business and look forward to ensuring a smooth brand transition for architect, fabricator and building developer partners who have relied on the design freedom of Dow Corning solutions for more than five decades.”



www.dowcorning.com

Community Stands at the Sensor+Test 2018

Digital transformation demands rethinking of established products, services, and value-added chains. Linking sensor and measuring technology with cyber-physical systems in the Industrial Internet plays a crucial part in this transformation. The next Sensor+Test from 26 to 28 June 2018 will therefore deal extensively with this exciting topic – and its numerous effects on all suppliers and users of sensor, measuring, and testing systems – at special forums and community stands:

Special Topic “Sensor and Measuring Technology in the Industrial Internet”

Greater efficiency, better performance, more security, and higher quality – that is the promise of the new technologies in the Industrial Internet and Industry 4.0. The key to that lies in the network and analysis of the operating data of machines, systems, and processes. Sensor, measuring, and testing systems provide this data accurately, reliably, and securely, allowing them to assume a key role in the industry of the future.

Special Topic “Digital Transformation”

Thanks to the linking of intelligent objects, such as mobile phones, cars, or even entire factories into a network, it is now possible to acquire and exchange data in large quantities. This in turn makes it



feasible to map the existing environment on computer-based systems, increasing efficiency, accuracy, predictability, and – last not least – the economic benefit. The SENSOR+TEST 2018 offers enterprises the opportunity to present their products at the special forum “Industrial Internet of Things”

Theme Stand “Vision Sensors and Systems”

Image processing requires sensors and systems that are presented at the SENSOR+TEST. To emphasize this thematic connection, a “Vision Sensors and Systems” theme stand will be set up with particularly advantageous conditions for exhibitors from this special discipline.

www.sensor-test.de

Renesas Successfully held its First European R-Car Consortium Forum

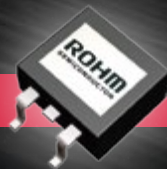
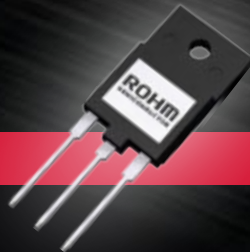
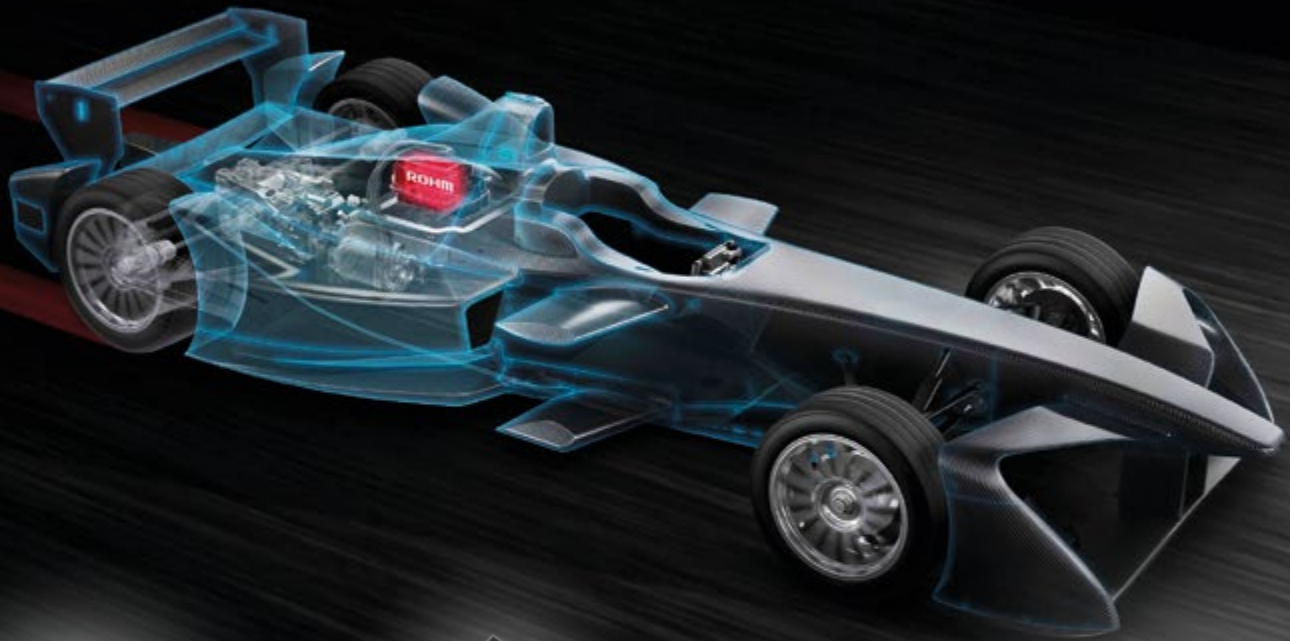
The Forum in Düsseldorf attracted a large audience of participants from over 35 automotive OEM and Tier 1 and connected car specialized IT providers. The R-Car Family is Renesas’ family of innovative and high-performance systems-on-chip (SoC) for automotive applica-



tions. The R-Car Consortium (RCC) comprises over 220 partners around the world who work with Renesas’ R-Car in the development of their own products. The RCC is sparking innovation by making available to car OEMs & Tiers1s a large database of system solutions from a broad range of technology partners. RCC Forum is a regular event organized by Renesas and enabling fruitful exchanges and networking between technology partners and Renesas R-Car customers. More than 30 of these technology partners participated at the first European RCC Forum, which focused on the future of connected car, advanced driver assistance systems (ADAS) and automated driving. “We’re delighted with the success of the first European R-Car Consortium Forum,” said Guenther Elsner, Vice President Automotive Solution Business Unit, Renesas Electronics Europe. “It looks like it will become a must-attend event in the automotive world like the equivalent forums in Japan. We’re proud to be working with such innovative partners to shape the future of mobility together.”

www.renesas.com/en-eu

SMALLER STRONGER FASTER



The Formula E Venturi team has adapted the latest range of ROHM inverters derived from full SiC module technology in its electric-powered racing cars. ROHM has enabled the broad implementation of e-mobility by delivering the next generation of power semiconductor-based SiC modules. It produces these in-house using a vertically integrated manufacturing system, thus guaranteeing high quality and consistent supply to the market.

SMALLER

SiC technology allows the chip to be reduced in size, leading to a SMALLER inverter in terms of dimensions and weight.

STRONGER

SiC increases thermal efficiency and power density for a STRONGER performance.

FASTER

SiC helps vehicles to cross the finish line FASTER and supports fast-charging solutions.



www.rohm.com/eu



Merck brings Material Solutions to the Automotive Industry

Merck is offering material solutions to the next generation automotive applications. Future automotive requires different features from current electronic devices, such as heat resistance, safety and long-lasting functionality chips. As materials plays a key role in the performance and reliability of advanced IC chips, Merck is offering a broad portfolio of solutions in the semiconductor chip manufacturing and packaging to meet the needs of the automotive industry. According to IHS Market's Luca De Ambroggi during his presentation at SEMICON West 2017, a high-end car will contain more than \$6,000 worth of electronics in five years, driving a \$160 billion automotive electronics market in 2022. Advanced IC chip packages, power systems, microcontrollers, sensors, camera, analog devices and application processes are driving the greatest adoption of semiconductor technology. Further, automotive has additional requirements regarding redundancy and specific chip packaging, as well as minimum requirements for performance, reliability and operation for more than 10 years under harsh conditions (e.g., high temperature). Electric vehicles and autonomous driving are key drivers for electronics' continued growth in semiconductor sector, representing a new frontier for automotive electronic packaging and safety features. Future artificial intelligence platform applications will require ongoing collaboration with chipmakers and the automotive industry to understand their specific needs.



"Merck is providing a broad range material solutions specifically for the automotive industry," said Benedikt Ernst, head of Business Field Semiconductor Packaging Solutions at Merck. "Merck can build on a 350 years of experience in chemistry, premium product quality and technology. We have a strong expertise in semiconductors, opto-electronics, display and industry sectors. Based on our close cooperation with the automotive OEMs we are confident to become the premium material solution partner to enable future autonomous car."

www.merck-performance-materials.com/en/index.html

Vincotech Donates €15,000 towards Green Up-Skilling in West Timor

Putting the finishing touch on another successful year, Vincotech, a supplier of module-based solutions for power electronics, has pledged €15,000 to a Plan International project in Indonesia. The company has again opted to embrace the seasonal spirit of giving by donating to a worthy cause in lieu of traditional gifts to business partners.



Eckart Seitter

This project imparts green agricultural skills to young women and men. Although the training qualifies rural youth for the formal labor market, it also does the environment a good turn. Around 500 young adults aged 18 to 29 are afforded the opportunity to earn a steady income while contributing to the region's sustainable development.

Maike Röttger, National Director of Plan International Germany, says, "Vincotech is a long-standing partner of Plan International and engages in many ways in the work we do. We thank Vincotech for this generous donation to the project in West Timor, which Vincotech had already supported this summer."

Eckart Seitter, Senior VP Sales & Marketing at Vincotech, adds, "Vincotech stands for reliable partnership with our customers and business partners. It's a priority for us to engage in charitable and community activities to give back to society. As a core component of technology such as drives and solar inverters, our power modules contribute significantly as efficient energy use, and Vincotech thus contributes sustainably to environmental conservation efforts. That is why we have supported this project on several occasions."

www.vincotech.com/Xmas_charity

STMicroelectronics Recognized for Leadership on Environmental Actions

STMicroelectronics has been identified as a worldwide leader in corporate sustainability, and awarded a position on this year's "A" List for water and "A-" for climate change by CDP, the non-profit environmental disclosure platform.

Among the 2,025 companies that were evaluated worldwide, the Water "A" List recognizes the top 10% of companies participating in the CDP's water program, for their actions in the last reporting year to manage water more sustainably. ST is one of only three semiconductor manufacturers worldwide to be recognized. The Company's "A-" score for climate change is also among the 22% highest scoring companies. CDP assigns the ST results to its Leadership level, underlying that the Company has implemented a range of actions to manage climate change within its own operations and extending to its supply-chain ecosystem.

"The semiconductor manufacturing process requires large quantities of water with a very high level of purity. Tackling the challenges of wa-

ter scarcity and wastewater treatment has been a fundamental part of our strategy since 1994. Over the course of 20 years, our overall water footprint has been reduced by more than 70% through continuous improvement programs undertaken at all our manufacturing sites and, in responding to climate change, our carbon footprint per wafer has been divided by 4," said Carlo Bozotti, President and CEO, STMicroelectronics. "With corporate social responsibility as an integral part of the company DNA, ST continues to work in all its manufacturing sites and throughout its supply chain to minimize environmental impacts and operate as a responsible global organization."

www.st.com/content/st_com/en/about/st_approach_to_sustainability.html

www.st.com

www.cdp.net/en/scores-2017



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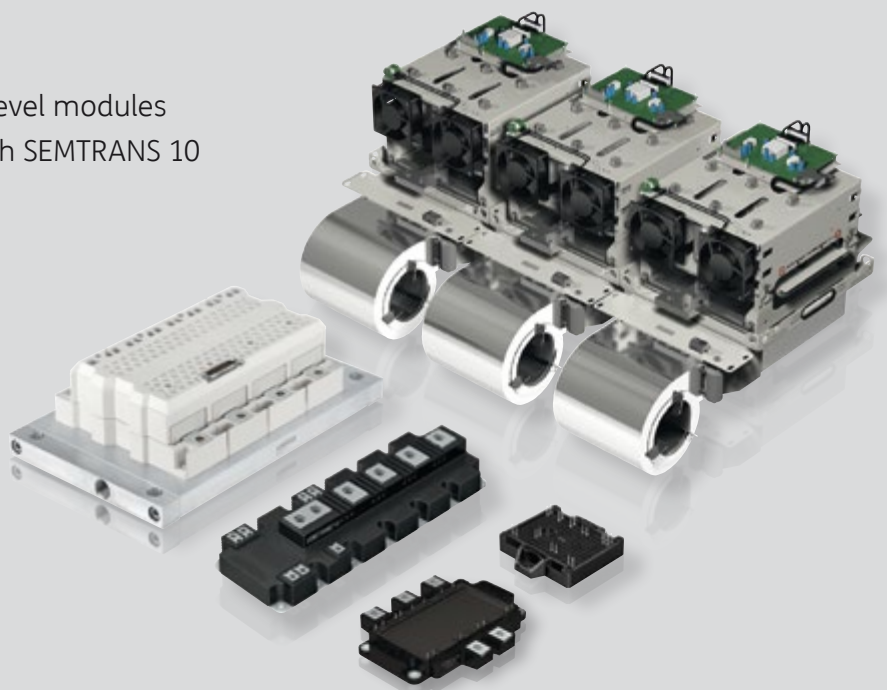


ABB powers 450kW fast charging for Electric Buses in Gothenburg

ABB has announced a project with Volvo Buses, Västtrafik and Göteborg Energi to bring its 450kW Opportunity Charging (OpCharge) system to the city of Gothenburg. Due for delivery in spring 2018, two fast chargers will be installed at Sahlgrenska University Hospital and Eriksberg Square, on line 16 of the city's bus network, on which two prototype electric articulated high capacity buses from Volvo will operate.

The order comes after a successful two-year trial under the ElectriCity venture, during which 10 all-electric or partially electrified buses have run on the city's bus route 55. Lotta Brändström, CEO of Göteborg Energi, explains: "We are committed to providing charging solutions for Gothenburg, whether that is for EV passenger cars or for the city's public transport network. The transition of the transport sector is one of our biggest challenges and we understand that this will take



the combination of many different solutions." When the Volvo Ocean Race is staged in Gothenburg in June 2018, two electrically powered articulated buses will showcase the latest developments. These two prototype buses will then run on route 16, which will be equipped with charging infrastructure and bus stop facilities for electrified high-capacity traffic.

"The fact that the chargers operate so quickly is vital for keeping traffic moving and for increasing the capacity of the network," added Fredrik Persson, project manager at Göteborg Energi. "The efficiency of ABB's new charging stations in combination with their high performance is the key to the concept."

www.abb.com

www.goteborgenergi.se

Smart Systems Integration 2018: Conference program now available

The conference program for Smart Systems Integration 2018 has been published and includes a range of top speakers from science and industry. The representatives will be presenting innovations,



applications and trends in the field of smart systems in Dresden, Germany from 11 to 12 April 2018.

Participants can expect a diverse program with five keynote, 54 lectures, two special sessions by the European Technology Platform on Smart Systems Integration (EPoSS) and more than 35 poster presentations. Four sessions will focus on either System integration technologies or Design of smart systems.

"The Smart Systems Integration [...] conference addresses the application fields of smart systems as well as smart systems themselves, starting from the design via new building blocks for sensing, data processing, actuating, networking, and smart powering up to heterogeneous integration of the different building blocks and manufacturing of the systems.", summarized Professor Dr. Thomas Otto, Chairman of the conference committee from the Fraunhofer Institute for Electronic Nano Systems ENAS, Germany.

www.smartsystemsintegration.com

Rohm supplies Full SiC Power Modules to Formula E Racing Team Venturi

Rohm has announced that will provide the full SiC power modules to the VenturiFormula E team in the FIA Formula E 2017–2018 (season four), the leading racing event for electric vehicles. This module will support further improvements in the car's performance under racing conditions. As the leading developer of SiC power devices, Rohm



became Venturi's official technology partner in season 3, and provides the world's most advanced SiC power devices used in the inverter, which is the core of the electric vehicle powertrain. The inverter for season four features embedded full SiC Power module, making it 43% smaller and 6 kg lighter than the inverter for season two. Rohm will continue making technological advancement in power devices, contributing to the development of society.

Formula E is an all-electric-powered FIA (Fédération Internationale de l'Automobile) championship that began in 2014. The series has expanded to cities around the world which has to date included cities such as Hong Kong, Berlin and New York. By not using fossil fuels Formula E champions a clean environmental approach. The key to victory in this racing series for the drivers is to use power as efficiently as possible by getting the maximum performance out of the stored energy.

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- Enhanced 3rd quadrant operation

Short Circuit Rated

- 4 μ sec typical



SPS IPC Drives sets new Records in 28th Year

Having featured 1,675 exhibitors on 130,000 square meters across 16 exhibition halls this year, the biggest SPS IPC Drives ever is set to wrap up today. The event also drew a record number of visitors in 2017, as 70,264 well-informed attendees took the opportunity to learn about the latest solutions in industrial automation. As we approach the end of 2017, SPS IPC Drives has reaffirmed its reputation as an annual highlight and the automation industry's leading exhibition. The event was officially opened on Tuesday by Dr. Thomas Schäfer, the Hessian Minister of Finance. Mr. Schäfer praised the SPS IPC Drives as a central platform for industrial automation, which is one of the core competencies of the German economy.

This year's event owes much of its success to the extraordinary level of innovation on display at virtually every booth occupied by its 1,675

exhibiting companies. Indeed, the exhibition floor was buzzing with attendees' in-depth discussions of new products and market launches, as well as glimpses into the future of automation. With its fresh focus on software and IT in manufacturing, the newly aligned Hall 6 proved to be particularly popular. The professionals in attendance showed a keen interest in industrial web services, digital business platforms, and other solutions in software, cybersecurity, and the cloud. They also took advantage of the chance to find out more about current industry topics in this year's topic-specific showcases, which included the shared booth "Automation Meets IT".

www.mesago.com

Indium Promotes Anita Brown to Associate Director Marketing Communications



Brown is responsible for managing the strategic planning initiatives for the Marcom Department, driving vendor selection, and managing customer, media, community, and internal communications. She also works closely with Indium Corporation's product managers to create impactful product branding and communication programs. She joined Indium Corporation in 2004 and has served in a variety of roles in the marketing communications department,

most recently as Senior Marketing Communications Manager. Brown earned her bachelor's degree in Business & Public Management and

her MBA in Technology Management, both from the State University of New York's Polytechnic Institute. She was recognized with the Dean's award from SUNY Poly School of Business in 2009, the Women in Business Award from the Mohawk Valley Business Journal in 2005, and the Follow the Leaders Award from Leadership Mohawk Valley in 2005. In 2017, she was recognized as one of the Mohawk Valley's outstanding women in business by the YWCA's Salute to Outstanding Women. Brown serves as chairperson for the SUNY Poly Foundation for the State University of New York's Polytechnic Institute and has been recognized three times as a Paul Harris Fellow by Rotary International.

www.indium.com

Audi relies on Infineon

Infineon supplies key components for the Audi A8, the world's first series production car featuring level 3 automated driving. The ability of cars to self-drive is split into a number of different levels: With level 3 (see explanation below), drivers can temporarily take their hands off the steering wheel under certain conditions. For example, the A8



allows this when parking and exiting, in slow-moving traffic or in traffic congestion. Thanks to microelectronics from Infineon Technologies, a car can take over in this kind of driving situation.

"Around 90 percent of innovations in the car are driven by electronics and hence by semiconductors," says Peter Schiefer, President of the Automotive Division at Infineon. "We have been a recognized semiconductor partner of Audi for many years. Motoring is now safer, more convenient and more environmentally-friendly with "Vorsprung durch Technik" (Progress through Technology) and chips from Infineon. We are proud of our contribution toward the mobility of the future."

www.infineon.com/automotive

Guanghua Yang to take up Vice President and General Manager



TE Connectivity (TE) has announced the appointment of the post of vice president and general manager TE Connectivity Industrial Business Unit Systems. Mr. Guanghua will take up his new appointment on 1 January 2018. He will report to Lars Brickenkamp, Senior Vice President and General Manager of TE's Industrial business unit – and will be based in TE Connectivity Industrial Business Unit Systems global headquarters in Shanghai, China.

Guanghua Yang holds a Bachelor Degree of Science from Lanzhou University of Technology and an MBA from Tsinghua University. He joins TE Connectivity from Nanjing Phoenix Contact Co. Ltd., where his most recent post was Vice President Device Connector Segment. Previously he held a number of senior Sales and Marketing posts at Schneider Electric and technical and managerial posts at SINOPEC Lanzhou Petrochemical Factory.

Mr. Guanghua, who is a Chinese national, will apply his extensive technical experience and in-depth industrial knowledge in order to provide an extraordinary customer experience.

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Axial-lead Hybrid Polymer Al Caps with Highest Current Ratings

TDK has succeeded in developing the world's first hybrid polymer aluminium electrolytic capacitor in axial design, resulting in automotive capacitors with highest current ratings. The new technology offers an unrivalled capacitance of 1300 μF at a rated voltage of 25 V and an extremely low ESR of just 3 m Ω . The new capacitor's dimensions are a compact 14 mm x 25 mm. With the Epcos axial-lead hybrid polymer aluminium electrolytic capacitors, too, the company is setting a new benchmark.

By Roland R. Ackermann, Correspondent Editor Bodo's Power Systems

The new hybrid polymer aluminium electrolytic capacitors feature an ESR that is up to 8.5 times smaller than that of standard aluminium electrolytic capacitors. As a result, the new capacitors offer an extremely high ripple current capability of up to 16 A at 10 kHz and 125 °C case temperature, compared to about 6 A for standard types.



Thanks to their high capacitance per volume, where they are indispensable in most automotive systems, aluminium electrolytic capacitors stabilize the operating voltage and thereby safeguard the reliable functioning of the systems. In recent years, TDK has developed and continuously optimized aluminium electrolytic capacitors especially for automotive applications. The culmination of these development efforts so far have been axial-lead types with a high vibration strength of up to 60 g and for permissible operating temperatures of up to 150 °C. One of the key characteristics of aluminium electrolytic capacitors is their ESR: When an alternating current – the ripple current – is applied, power losses occur proportionately to the ESR that heats up the component ($PL = ESR \times I_{2AC}$). ESR, in combination with the thermal resistance, is thus the main factor limiting the current capability of an aluminium electrolytic capacitor.

Hybrid polymer technology significantly reduces the ESR. Therefore, in order to lower the ESR substantially, the new caps have turned to hybrid polymer technology, which combines a polymer with a high conductivity of around 1000 S/cm with a liquid electrolyte.

In addition to lowering the ESR, hybrid technology offers one other advantage over the use of polymers alone: Hybrid polymer aluminium electrolytic capacitors are self-healing and are able to re-oxidize defects in the dielectric oxide layer of the al cap. As a result hybrid polymer al caps feature higher dielectric strength, temperature resistance and durability than pure polymer aluminium capacitors.

Conventional hybrid polymer technology offers a ripple current capability that is 2 to 5 times higher, depending on temperature and rated voltage. The capacitance values and rated voltages of the capacitors currently available on the market, however, are relatively low. Typical values are 270 μF at a rated voltage of 35 V with dimensions of 10 mm x 10 mm (D x H) in the SMD version. Such capacitors have ESR values in the range from 10 m Ω to 15 m Ω .

The patented material, process and design innovations include:

- Optimized structure and composition of the solid/fluid electrolyte system
- Filling of polymer material into large windings
- Extremely low metal resistance by means of multi-tab connectors in order to exploit the high conductivity of the polymer in combination with very low ESL, even in large designs.

Advanced ferrite materials and geometries

New ferrite material and improved geometries for the core designs (distributed air-gap) ensure improved efficiency, which – apart from miniaturization – is the most important development goal in the design of power supply units. Every tenth of a percent counts. Except for the power semiconductors, ferrite cores are the decisive factor for efficiency.

In order to be able to exploit the advantages of new (wide bandgap) semiconductors, TDK has developed the new PC200 ferrite material based on MnZn that is designed for the frequency range between 0.7 MHz and 4 MHz. The maximum transmissible power is reached at a switching frequency of between 1.8 MHz and 2 MHz and an operating temperature of 100 °C. The Curie temperature is in excess of 250 °C and the PC200 ferrite material is particularly suitable for transformers

based on ring or planar core topologies. With its optimum performance at a frequency of about 2 MHz the new PC200 MnZn ferrite material is ideally suited for topologies of power supplies that are based on new wide bandgap semiconductors such as GaN and SiC.

New wide bandgap semiconductors such as GaN and SiC are facilitating further advances, because they can switch higher frequencies with higher slew rates and lower losses. This means that, in principle, it is possible to use considerably smaller inductors and transformers, or to handle higher power ratings with a component of the same size. The disadvantage is that conventional existing power ferrite materials are not designed for frequencies in the MHz range, where they exhibit greater losses than at lower frequencies.

The use of single air gaps in ferrite cores is a common technique today for delaying the core saturation and thus increase the performance. These relatively large, single gaps however result in a higher fringing flux effect, leading to additional copper losses, particularly at high frequencies. With new geometries and the core manufacturing technique of distributed air gaps, TDK is the first ferrite core manufacturer to offer an elegant solution for reducing electromagnetic emissions and thus heating. By arranging the gaps in the center post, the magnetic field emissions to the environment is effectively prevented.

Different sized cores are available with three distributed air gaps in E, EQ, ER, ETD, PM and PQ core design. Solutions with three air gaps offer the best cost/performance ratio for applications in which the switching frequency is 2 or 3 times higher than the original frequency. This enables the losses to be reduced by up to 70 percent.

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Buck-Converter with Record Step-Down Ratio

During the SPS IPC Drives Exhibition in Nuremberg Rohm Semiconductor presented its new power supply IC in Nano Pulse Control® technology, achieving the industry's highest step-down ratio of 24:1 between input and output voltages.

By Roland R. Ackermann, Correspondent Editor Bodo's Power Systems

Automotive and industrial sectors are the prime focus of the European subsidiary of Rohm Semiconductor, with the sales in this region meanwhile taking 57 and 19 % respectively. Major growth is expected, especially based on four solution areas: High performance analogue, Power – centering on SiC devices, Sensors – introducing MEMS and motor drive solutions.

Innovative Step-Down Power Supply IC

The company announced the BD9V100MUF-C, a DC/DC converter with built-in MOSFET that can generate output voltages of just 3.3V or 5V (minimum 2.5V) from input voltages up to 60V at a switching frequency of 2MHz. The IC therefore achieves the highest step-down ratio in the industry – 24:1 – between input and output voltages.

To obtain this voltage ratio, the chip uses the proprietary, patent pending Nano Pulse Control technology with current mode control, which leverages high-voltage BiDCMOS processes and ultra-high-speed pulse control to realise an unprecedented ON time of just 9ns. The new technology enables single-stage voltage conversion in 48V systems such as those used in mild hybrid vehicles. At 2MHz the number of parts required is halved, reducing application size and simplifying system design, while high-frequency operation also permits the use of smaller external components, e.g. coils and output capacitors.

Nano Pulse Control refers to ultra-fast pulse control technology achieved by combining analogue circuit design, layout and processes utilising Rohm's vertically integrated production system. This contributes to greater miniaturization and system simplification in 48V applications ranging from mild hybrid vehicles and industrial robots to base station sub power supplies.

The device features extensive protection features: over current, under voltage, thermal shutdown and short circuit protection in a VQFN24SV4040 package of 4.0mm x 40mm x 1.0mm. Key specifications are:

- Input voltage range 16V – 60V (absolute ratings 72V max)
- Output voltage range 0.8V – 8V
- SW minimum ON time 20ns (max)
- Output current 1A (max)
- Oscillation frequency range 1.9 – 2.3MHz
- Reference accuracy ±2%
- Standby current 0µA
- Operating temp range between -40°C and +125°C.

Typical applications include automotive battery powered supplies, industrial equipment and industrial battery-operated devices.

Availability: Samples of the BD9V100MUF-C are available now, OEM quantities from December 2017.



The trend towards 48 V systems

Energy savings and environmental performance are the driving forces behind constant innovation in the automotive industry. Through optimized power distribution, mild hybrid vehicles with 48 V systems achieve significantly lower energy and fuel consumption, which in turn reduces CO2 emissions. Active systems for enhanced comfort in automobiles, such as brake-by-wire or electric power steering, increase the electrical power requirements. In traditional 12 V systems, electrical energy has to be transported to loads at a low voltage level, causing increased losses in the wiring harness. The need for thicker copper wires also adds weight, with a negative impact on fuel consumption. Using 48 V technology cuts the amount of electricity transferred by a quarter, so reducing losses in the wiring.

At system level, automobile electronics and sensors typically require a supply voltage of between 1 V and 5 V. This means that the 48 V bus voltage has to be stepped down to the lower voltages. At the same time, it makes sense to operate the DC/DC converter at 2 MHz, as this will not affect the AM radio band (1.84 MHz max.) and allows the most compact solution.

To date, no power supply IC has achieved both a high conversion ratio and a high switching frequency. A two-stage solution meets these requirements, but has various disadvantages: it takes up more space, uses more components, and is a more complex system. Now, with the BD9V100MUF-C, Rohm is offering a single-stage voltage conversion solution.

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High Power next Core (HPnC) with Fuji Electric's X-Series – 7G IGBT



FEATURES

■ Latest chip technology (X-series and SiC-SBD)

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- › Also available with Fuji SiC FWD

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- › CTI>600 for higher anti-tracking
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- › Improvement of delta Tj power cycle capability by using 7G Package technology
- › Tj operation target is 175 °C

■ RoHS compliance

- › RoHS solder
- › Ultra sonic welded terminals

■ Over temperature protection

- › Thermal sensor installed



High-speed, Multi-channel Waveform Recording for Evaluating Inverter Drive Systems

200MS/s Isolated Sampling Across Multiple Channels and Real-time Save to External Storage Aply Respond to Higher Carrier Frequencies of PWM Inverters

Some 35 years have passed since Hioki introduced the first Memory HiCorder waveform recorder in 1983. Today, the line has expanded to include a broad range of models, including two-channel variants that deliver functionality in a compact, lightweight footprint; four-channel portable models that can accept high-voltage input; standard and vehicle-use versions that allow users to freely choose the number of channels thanks to a modular plug-in architecture; and multichannel models (with up to 54 channels) that are designed to be embedded in systems and production lines.

By Takashi Hama, HIOKI E.E. Corporation

Introduction

Most recently, Hioki added the Memory HiCorder MR6000, a flagship model that delivers high-speed isolated measurement at 200 MS/s - 10 times faster than legacy model - along with the ability to save data in real time at 32 times the speed of legacy models. (Figure 1)



Figure 1: Hioki MR6000 Memory HiCorder

Difference Between Memory HiCorders and Oscilloscopes

Generally speaking, waveform observation instruments take the form of either oscilloscopes in the high-speed domain or Memory HiCorders in the medium- and low-speed domain. Oscilloscopes are functional in that they can observe high-speed phenomena, but their reliance on a common ground for all channels raises the risk of inter-circuit shorts and ground faults when measuring circuits where

the ground is subject to a potential difference or control circuits carrying both high and low voltage. The industry welcomed the Memory HiCorder as a waveform observation instrument that can be used safely and with peace of mind in such measurement environments because its channels are isolated from one another and from the instrument's enclosure. Hioki has adopted a modular plug-in architecture for the Memory HiCorder's internal circuitry to accommodate demand for the ability to simultaneously measure not only voltage signals, but a range of physical phenomena including current, temperature, vibration, pressure, acceleration, and rotational speed. The result is a line



Figure 2: 10 Types of Input Modules

of instruments that can measure an array of physical phenomena on a single time axis.

The newly developed Memory HiCorder MR6000 is compatible with the 10 types of measurement modules available for existing models (the MR8847A series), and it provides input circuitry designed to meet a variety of demands. (Fig. 2) For example, maintenance and troubleshooting of grid-tied solar and wind power systems as well as electric vehicles (EVs) require simultaneous measurement of a variety of electric signals, ranging from high voltages to minuscule voltages

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from sensors and control signals. Hioki recommends the High Voltage Input Module U8974, 4ch Analog Unit U8975, and High Resolution Unit 8968 for use in such applications. The newly developed 4ch Analog Unit is capable of simultaneously measuring up to 32 channels at 16-bit resolution and a speed of 5 MS/s, making it ideally suited for use in applications where numerous phenomena must be measured at the same time.

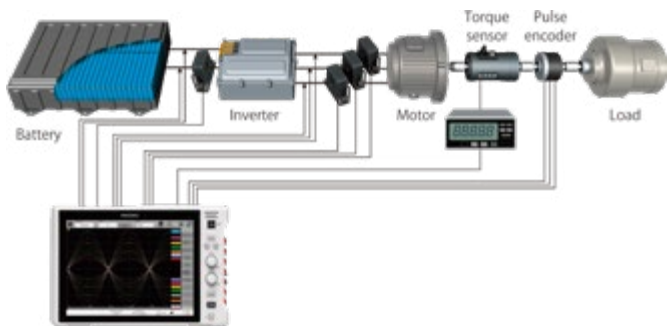


Figure 3: MR6000 Used in the development of PWM inverters

Applications in PWM Inverter Development

In the development of PWM inverters that combine high-response performance with compact size, an ongoing shift to higher carrier frequencies means a need for higher bandwidth analog characteristics and sampling speeds that are fast enough to catch instantaneous variations. (Figure 3) For use in such applications, Hioki recommends the High-Speed Analog Unit U8976, which delivers a sampling speed of 200 MS/s—the fastest in Memory HiCorder history—along with frequency characteristics from DC to 30 MHz. (Figure 4) The U8976 can accept direct input of up to 400 V DC, and it can measure voltage of up to 1000 V DC when used in combination with the optional 9665 10:1 probe. Naturally, the 4ch Analog Unit U8975 and High-Speed Analog Unit U8976 mentioned above can be used safely and with peace of mind since the channels are isolated from one another and from the instrument's enclosure.

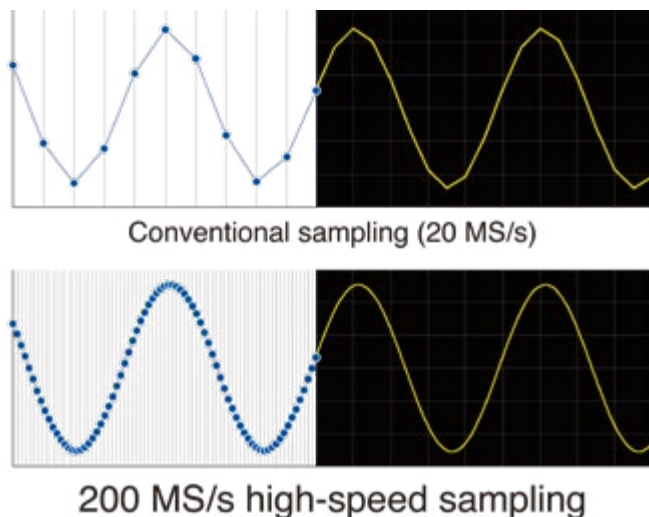


Figure 4: Difference between 20MS/s and 200MS/s sampling

The Memory HiCorder MR6000's appeal goes beyond its input circuitry's isolation performance and an extensive selection of modules that can measure numerous phenomena. Other features address measurement over extended periods of time. Recent technological progress has made it more difficult to detect anomalies in signal waveforms, creating uncertainty about how to best configure trigger

conditions. Increasingly widespread adoption of simulation techniques in development work has led to situations where engineers have only once chance to acquire data during actual testing. In such applications, there is a need to take advantage of the measurement opportunity in order to capture all phenomena at once. Hioki recommends saving data in real time to the internal SSD Unit U8332. The Memory HiCorder MR6000 can record 32 channels of data at a sampling speed of 1 MS/s for about 1 hour if this SSD is chosen as the destination for saved data. The instrument can also send data for 8 channels sampled at 1 MS/s in real time to a LAN-connected computer so that analysis can begin as soon as measurement is complete.

Special Features of the MR6000

Having engineered the ability to capture all phenomena during a single measurement opportunity, we asked how anomalies could be more readily detected. It's not practical to scroll through all captured data while checking it visually. Hioki recommends Memory HiCorder Concierge, a waveform search function built into the Memory HiCorder MR6000, to aid in this task. Simply choose the fundamental waveform after measurement is complete and press the "Search" button to start searching. The Memory HiCorder MR6000 will automatically detect the characteristics of the fundamental waveform and search through saved data in order, looking for anomalous waveforms exhibiting a low degree of similarity. This approach can be expected to yield a significant improvement in work efficiency compared to the practice of scrolling through data while visually checking the waveforms.

Apart from its waveform search function, the instrument provides other functionality designed to boost work efficiency by saving data more quickly and enhancing ease of use. Because they are designed to measure over extended periods of time, Memory HiCorders often are called upon to handle extremely large volumes of data. Consequently, users have faced the issue of long save times when writing data to USB memory sticks. To resolve this problem, we redesigned the Memory HiCorder MR6000's interface to implement support for USB 3.0 and GbE. We also improved the process by which data is transferred from the instrument's internal memory, reducing the time required to save data to external media to about 1/10 that of the previous instrument. In addition, previous Memory HiCorders required numerous button operations to configure the desired settings. We addressed this issue by equipping the MR6000 with a touch screen so



Figure 5: Touch screen operation

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Dresden, Germany, 11 – 12 April 2018

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that users can quickly and easily configure the instrument by directly touching the desired parameter. (Figures 5 and 6) We are confident that faster saving and improved ease of use will help customers reduce work times.



Figure 6: Touch screen intuition

Conclusion

The Memory HiCorder MR6000 is a waveform recorder that combines high-speed isolated measurement with the ability to measure and record a large number of phenomena over extended periods of time. In today's increasingly diverse, complex systems, verifying overall equipment operation and capturing unexpected phenomena requires the ability to measure more signals along the same time axis. For example, the overall operation of an inverter system can be checked by simultaneously measuring the primary- and secondary-side voltage and current, logic control signals, switching device temperature, and motor RPM and vibration. The instrument's design also reflects close attention to detail in terms of its high-speed performance by supporting the high-speed transfer of data to computers, as is required in recent computer measurement applications, and by saving data to external media more quickly to address an area of dissatisfaction with the previous instrument. The Memory HiCorder MR6000 can be expected to play a key role in the discovery of difficult-to-detect anomalous phenomena in research and development.

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3.3 kV Full SiC MOSFETs – Towards High-Performance Traction Inverters

Mitsubishi Electric is developing a new Full SiC device rated for 3.3 kV and 750 A. The device comes in the most recent LV100 package, which is especially suitable for traction application and modular converter designs. This article introduces the new Full SiC device and demonstrates the benefits in traction applications.

By Dr. Nils Soltau, Eugen Wiesner, Mitsubishi Electric Europe B.V., Ratingen, Germany and Kenji Hatori, Hitoshi Uemura, Mitsubishi Electric Corporation, Fukuoka, Japan

1. Introduction

Power semiconductor devices made of silicon carbide (SiC) are regarded as the major innovation in modern power electronics. Compared to classical silicon (Si) devices, SiC enables more efficient and more compact converters to save electric energy and valuable materials.

Over the last 20 years, Mitsubishi Electric has developed and commercialized SiC devices for several voltage classes and various applications [1]. Now, after years of in-field experience with different SiC modules in traction application [2], Mitsubishi Electric makes the next big step. With a rated voltage of 3.3 kV and a current of 750 A, the new Full SiC dual module is especially intended for high performance traction converters and flexible converter designs. The type name of this new device is FMF750DC-66A.

Due to the fast switching transients, Full SiC devices require an appropriate package offering low stray inductance. Therefore, the FMF750DC-66A, as shown in Figure 1, comes in the most advanced package for this voltage and power class: the LV100 package. This package offers a stray inductance below 10 nH and simpler parallel connection of several modules. Moreover, the internal package design ensures optimal current sharing among the semiconductor chips inside a module.



Figure 1: The new 3.3 kV Full SiC device is rated for 750 A and comes in the most recent LV100 package

2. Comparison with Silicon Devices

The following chapter compares the FMF750DC-66A with two different Si devices that also come in the same LV100 package. These two devices of the same voltage class are rated for 450 A and 600 A. In the following, they are referred to as CM450DA-66X and CM600DA-66X according to their respective type name. Figure 2 shows the static characteristics of all modules and, hence, demonstrates nicely

the general difference between bipolar IGBTs and unipolar MOSFETs. It should be noted that all device characteristics are given for the respective maximal junction temperature being 150°C for the Si devices and 175°C for the FMF750DC-66A. Due to the linear current-voltage dependency of MOSFETs, the voltage drop at low currents is substantially lower than for bipolar IGBTs (cf. Figure 2 (a)). As shown in Figure 2 (b), also the voltage drop of the FMF750DC-66A in reverse direction is much smaller compared to the freewheeling diodes of the Si modules, if both, diode (SBD) and MOSFET, are conducting the reverse current (synchronous rectifier mode). Consequently, especially at low-load conditions, the use of unipolar devices increases converter efficiency significantly. The subsequent chapter quantifies this for a traction application.

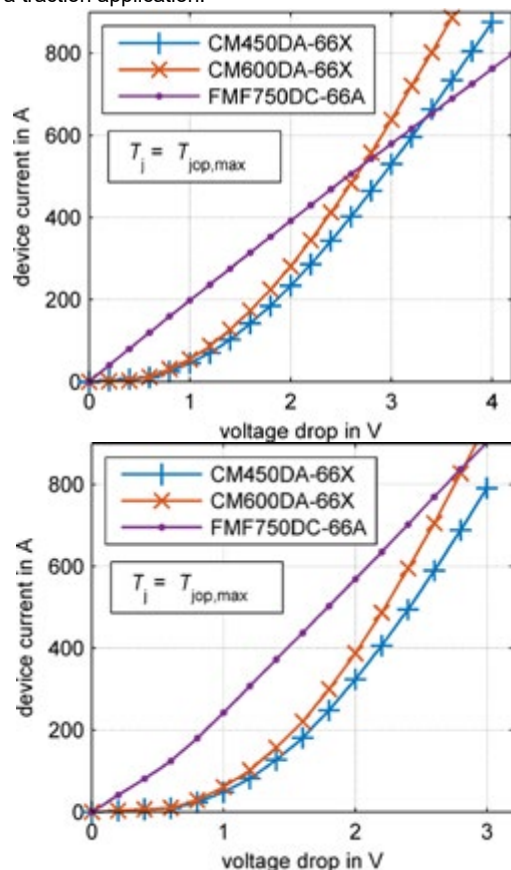


Figure 2: Static characteristic of the Full SiC devices compared to the 450 A and 600 A silicon-based modules

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Another very prominent advantage of Full SiC devices is the reduction of switching losses. Again, this effect results from the unipolar nature of the devices. The lack of reverse recovery and tail currents decreases switching energy and allows higher switching frequencies compared to Si devices. Figure 3 shows the sum of energy loss during turn-on, turn-off and reverse recovery. Compared to the Si-based IGBTs, the switching losses in the Full SiC module are reduced by 80 – 90 %.

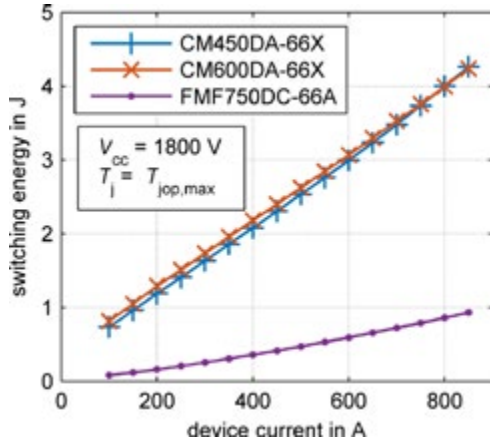


Figure 3: Switching losses of the Full SiC module compared to Si-based modules

The following chapter quantifies and discusses advantages for the converter design and intended applications.

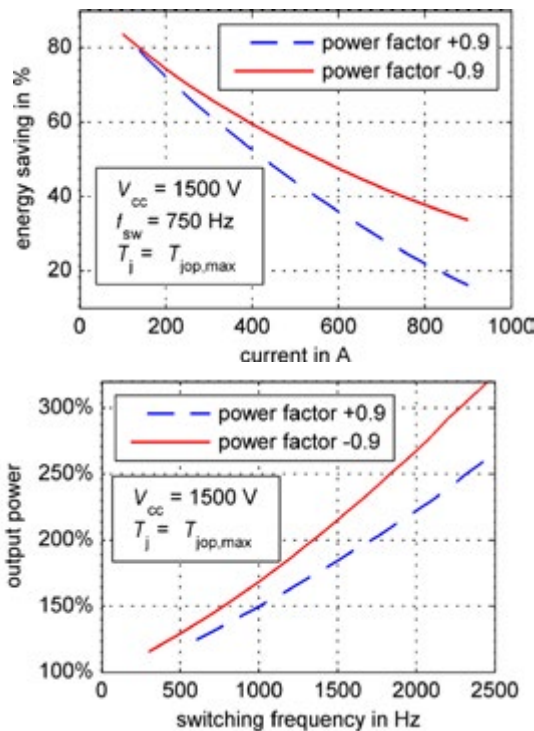


Figure 4: Comparison of FMF750DC-66A with CM600DA-66X

3. System Level Advantages

The first example regards traction inverters with 750 Hz switching frequency at 1500 V dc-link voltage. The losses generated by the Si-based CM600DA-66X and the SiC-based FMF750DC-66A are compared. Figure 4 (a) shows the energy savings using the FMF750DC-66A instead of a CM600DA-66X. Especially at vehicle’s part-load condition, saving potential is enormous. Below 400 A output current,

the Full SiC devices saves more than 50 % - 80 % of the energy loss by semiconductors (at the same device footprint).

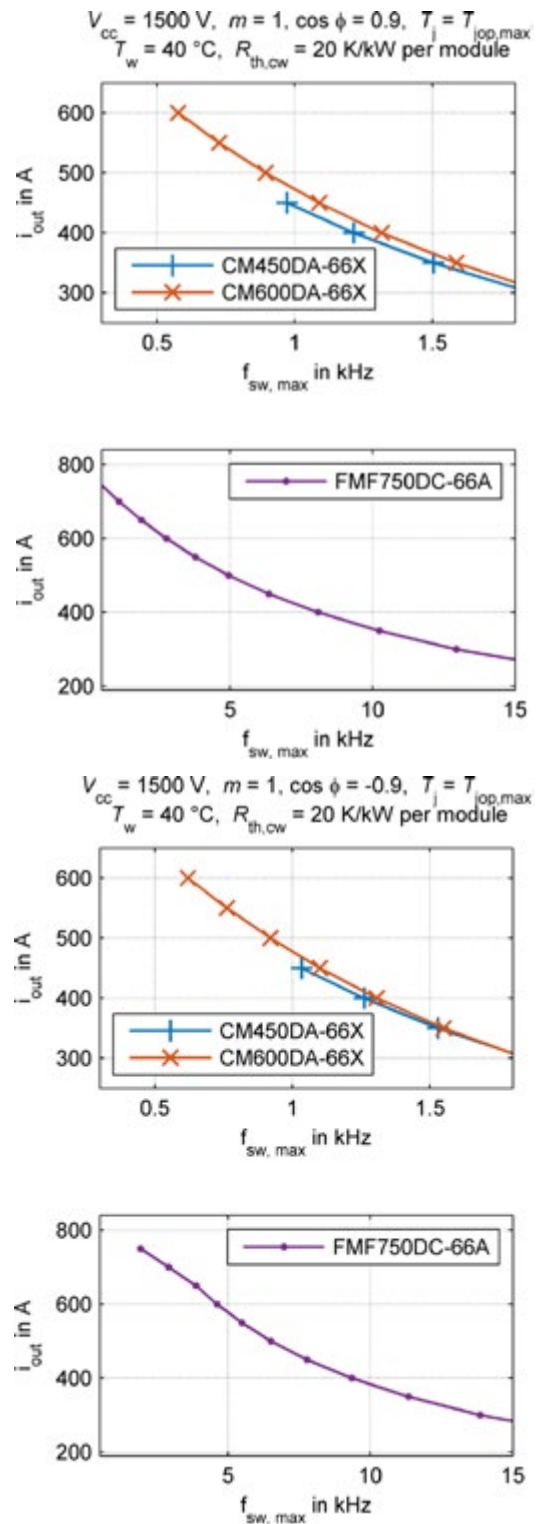


Figure 5: Maximal output current in dependence on switching frequency

Especially at part load, operational energy costs can be reduced. Moreover, due to higher efficiency and the higher operational junction temperature of the FMF750DC-66A, the maximal power in rectifier operation increases. As illustrated in Figure 4 (b), maximal output power increases by roughly 60 % at exemplary switching frequency

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of 750 Hz. Since the rectifier mode serves the recovery of energy when the vehicle slows down, potentially more energy can be recycled and fed back into the electricity network. Moreover, this reduces stress on the conventional braking system.

The second example considers a grid-connected converter operating at a power factor of 0.9. The maximal switching frequency in dependence on the output current is calculated. Figure 5 shows the results considering cooling water temperature of 40°C. Consequently, the maximal switching frequency for the FMF750DC-66A increases by a factor of 5 to 9 compared to the CM600DA-66X at same current level.

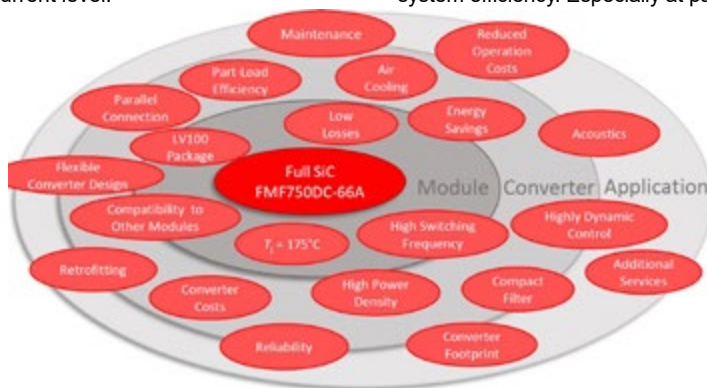


Figure 6: Opportunities enabled by the Full SiC FMF750DC-66A

The higher switching frequency allows converter manufacturers a grid-filter design for higher resonance frequencies. Consequently, the required inductance and capacitance values for an LCL filter decrease. This in turn decreases filter's size, cost and losses. Moreover, the converter achieves a more dynamic control. Furthermore, for machine-side inverters or dc-dc converters, the higher switching frequency enables the design of more compact high-speed drives and medium-frequency converters [3,4].

Besides the switching frequency increase, Figure 4 (b) has already demonstrated that keeping the switching frequency constant, the converter achieves significantly higher output power. The fact that the FMF750DC-66A comes in the same package as the CM450DA-66X and CM600DA-66X allows more flexible converter designs and fast development (having a similar inverter configuration as Si-based inverter).

Beyond the discussed benefits in traction and grid applications, the FMF750DC-66A make further benefits accessible. Figure 6 tries to illustrate the advantages of the FMF750DC-66A at different system levels: at module level, at converter level and at application level. In general the use of new

FMF750DC-66A makes sense in those applications where these system-level advantages potentially over-compensate the higher costs of today's SiC-modules compared to established silicon devices.

4. Conclusion

Mitsubishi Electric offers an extensive line up in the state-of-the-art LV100 package. Now, a 750 A Full SiC module is added to the 3.3 kV line up.

The FMF750DC-66A Full SiC module increases the converter's power density by increased switching frequency and higher maximal junction temperature of 175 °C. Moreover, the module achieves higher system efficiency. Especially at part load con-

ditions or rectifier operation, the FMF750DC-66A reduces the inverter losses by 50 – 80 %. The FMF750DC-66A comes in the same low-inductive LV100 package as its Si counterparts. For converter manufacturers, this simplifies the transition from Si to SiC and gives tremendous flexibility.

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IPM Cost Benchmarks

Higher integration and more complex subsystems are some of the current trends in power electronics. Vincotech's intelligent power modules show the highest level of integration among power modules currently available on the market, enabling significant system-level cost reductions and offering the best solution for space-constrained and cost-driven mechanical environments. This article describes the embedded drive assembly process and analyzes the costs for three alternative solutions.

By Michele Portico, Product Marketing Manager, Vincotech GmbH, Unterhaching

Intelligent power modules for Industrial motion control

Discrete drives are standard solutions designed to control a wide range of motion applications. Nevertheless, higher integration and more complex subsystems are some of the current trends in the industrial market and increasingly, companies are providing embedded drive systems with different levels of customization.

Embedded drive systems integrate all the control and power electronics together with the electric motor. Thanks to their compact and hermetical design, these help to reduce the space occupancy in the systems. Since they are dedicated to specific applications, design engineers can further optimize them to reduce the size and cost of the final product and increase the reliability and performance.

Highly integrated intelligent power modules represent a very cost-effective solution for this type of mechanical environment, as they dramatically reduce the number of external components and help minimize the system assembly time.

Assembly

During system assembly, one side of the power module is mounted on the printed circuit board (PCB) to connect it to the rest of the application circuitry, while the other side of the power module is typically connected to a heat sink to dissipate the heat generated by the electrical components in the power module itself (Figure 1).

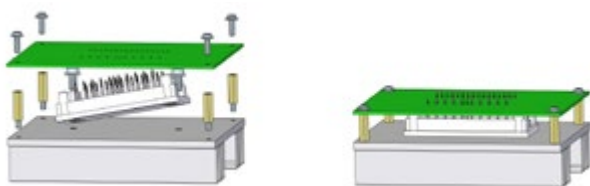


Figure 1: Module with PCB and heat sink

The electrical connections between the module and PCB can be made by soldering or by using Vincotech's Press-fit technology.

The distance between the top surface of the heat sink and the bottom surface of the PCB is typically defined by the height of the power module. PCB spacers can be used to ensure the correct distance. To ensure stability and robustness, the number and the position of the fixing points depends on many factors; for example, the design of the circuit, the location of different bulky components i.e. capacitors or inductors, and the operating environment of the system. Screws, springs and isolation pads may also be used during the mounting process.

Furthermore, the assembly process may require the drilling of holes in the heat sink and the application of thermal paste to the module-to-heat sink interface to improve the thermal dissipation.

Cost Benchmark

Table 1 shows the cost comparison between Vincotech's intelligent power module, a competing intelligent power module and a discrete solution:

	flowIPM	Competing IPM	Discrete
Cost of assembly (assembly material + labor)	10,10%	30,60%	71,90%
Module	89,90%	49,60%	0,00%
Discrete el. components	0,00%	29,20%	57,10%
Total	100,00%	109,40%	129,00%

Table 1: Cost comparison

Using Vincotech's intelligent power module as a reference, the normalized costs clearly show that the high level of integration of Vincotech's intelligent power module results in a significant system level cost saving and represents the best solution for space-constrained and cost-driven mechanical environments (Figure 2).

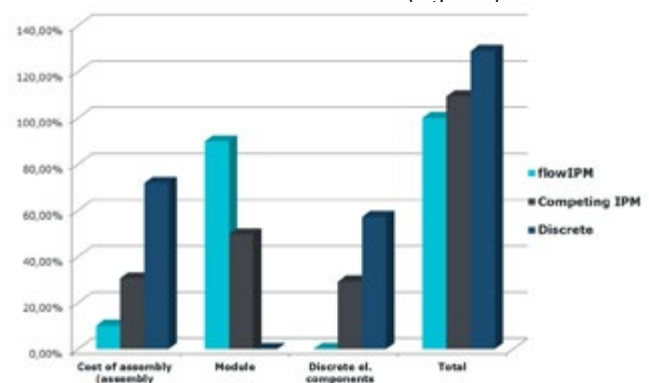


Figure 2: Cost analysis – flowIPM vs. discrete and competing IPM

The assembly costs can be dramatically reduced by integrating all the motor drive's functional blocks. Due to size constraints and application flexibility, the input filter, DC capacitor and microcontroller are typically not integrated.

Using integrated intelligent power modules simplifies and streamlines the motor drive assembly with fewer external components and smart isolation techniques. In addition, diode rectifiers, brake chopper or power factor correction circuits and sixpack output stages can also be integrated.

Digital Power Designs Made Easier

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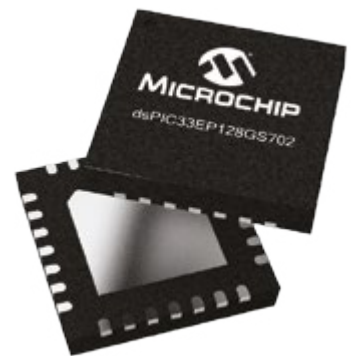


Microchip's digital power design suite includes the Digital Compensation Design Tool (DCDT), MPLAB® Code Configurator (MCC), Microchip compensator libraries and design examples.

These four components of the digital power design suite provide the tools and required guidance for developing complete digital power designs. Once the initial simulation model of your design is ready, the DCDT can be used to analyze the design and the feedback transfer function, and to generate compensator coefficients. Device initialization code can be generated with the help of MCC; and the final firmware can be created with some help from the code examples and the code generated from MCC and the DCDT.

Key Features

- ▶ Digital Compensation Design Tool to analyze your design
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Thick-film technology enables higher levels of integration, allowing the integration of gate drives, PFC controllers and passive components (see Figure 3).

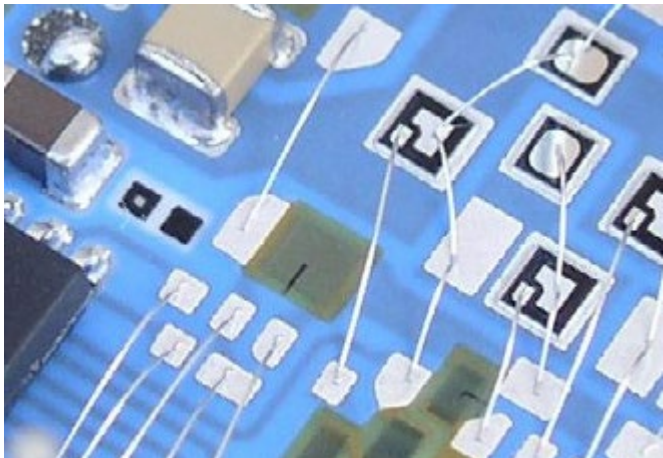


Figure 3: Thick film technology

Different layers of conduction and isolating materials are printed on a ceramic sheet. The layers can build tracks, pads, and resistors which can be laser-trimmed to achieve high levels of precision.

Additional cost savings can be achieved by using Vincotech's Press-fit technology (Figure 4). This further reduces PCB assembly time and effort by eliminating the need for soldering, cuts process time and costs, and boosts production output.

Conclusion

Vincotech's intelligent power modules provide the functional integration and power density that engineers need to design cost effective



Figure 4: Press-fit pins for solder less mounting

embedded drive systems. The high level of integration achieved by Vincotech's IPMs enables system engineers to develop more compact designs and take advantage of a proven combination of power components and gate drive circuits. As these are the most critical elements in the control and power electronics, this mitigates the risk associated with circuit design, speeds up development, and dramatically reduces both costs and time to market.

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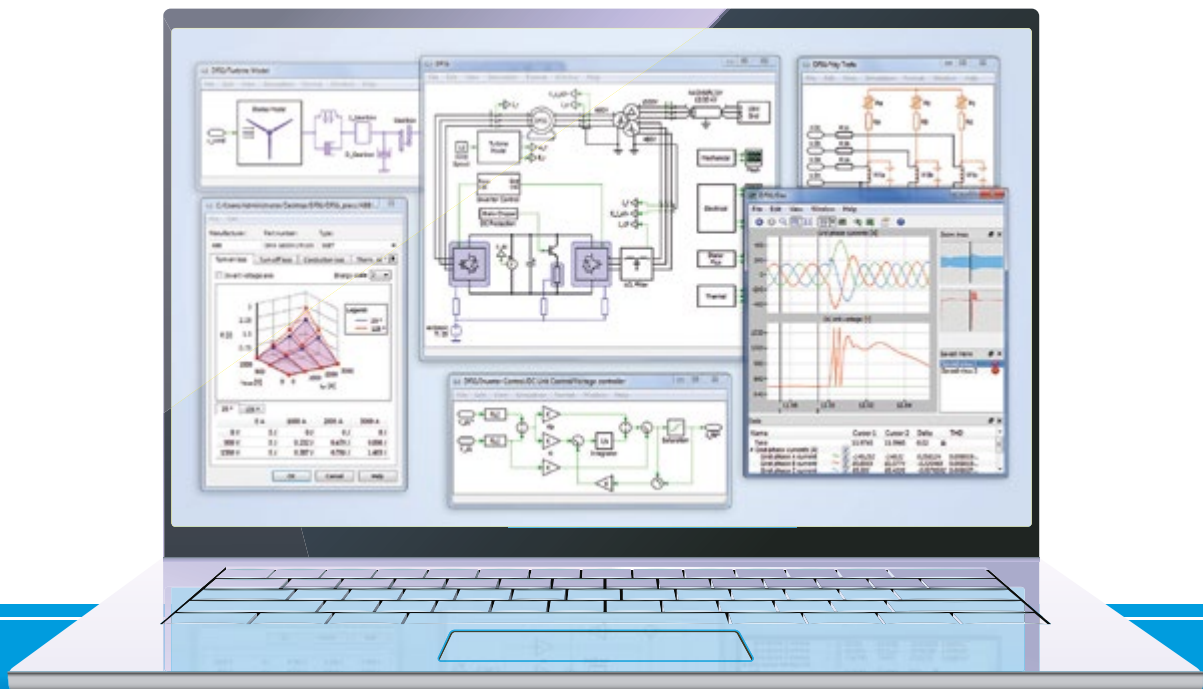
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Trends in Electromagnetic Component Design

Why You Shouldn't Underestimate Magnetic Technology

Electronic transformers, inductors and magnetic materials are ubiquitous in many applications, from power adapters, laptops & mobile devices, automobile electronics, LED lighting, medical electronics, industrial control, security systems, photovoltaic inverters, automobile charging stakes, UPS power sources and digital audio equipment. But the enabling technology remains unsung.

By Andrew Adams, Technical Manager, ETAL Group

For many designers, these magnetic and electromagnetic components are considered very "low tech". The reality is, however, that much technology and know-how is applied to designing and constructing these passive components.

Technological developments - energy efficiency, weight minimisation, surface mounting and miniaturisation - have been major factors in driving growth in this sector. Future growth in the markets for electronic coils, transformers and other inductors will be driven by new, high-tech electronic components.

Developments in materials, winding techniques and equipment, and design solutions are creating new optimised solutions across a range of applications.

It all starts with DESIGN. Practical electromagnetic component design requires knowledge of electrical principles, materials, as well as economics. Whilst small devices, for example low-voltage transformers under 10 kVA, may be designed using handbook data and pencil-and-paper calculations, specialist devices and larger or mass-produced units require extensive computer aided modelling (CAM).

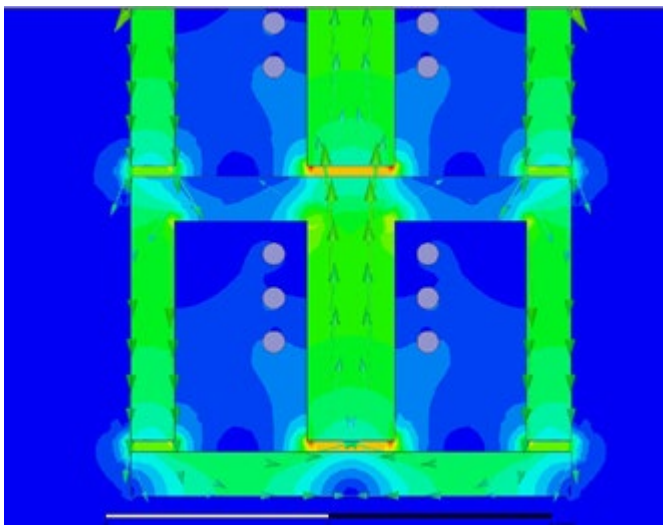


Figure 1: Electromagnetic field simulation

Advanced simulation and design builds from the basics

Even the most sophisticated design and analysis have at their heart the fundamentals of magnetic and electrical circuits - Maxwell's equations, Ampere's law, Faraday's law, Gauss's law and Lenz's law. Best in class design software takes these fundamentals and apply today's electromagnetic field simulation and modelling with sophisticated computation and visualisation techniques. For example, ETAL harnesses the power of simulation software based on the finite element method to simulate low-frequency electromagnetic fields in a wide range of industrial components. Examples run from 2-D magnetic transient, AC electromagnetic, magnetostatic, electrostatic and DC conduction to electric transient solvers. It will accurately solve for field parameters including capacitance, inductance, resistance and impedance.

Once we have the results, we can then build a full 3D CAD drawing, and customers can then move forward with the mechanical and electrical design of their system without the need for physical samples of the finished component.

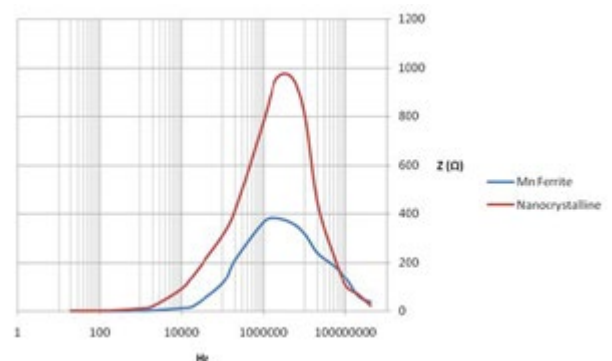


Figure 2: Nanocrystalline common-mode chokes provide damping of noise frequency over a wider frequency range – more double the range of ferrite alternatives

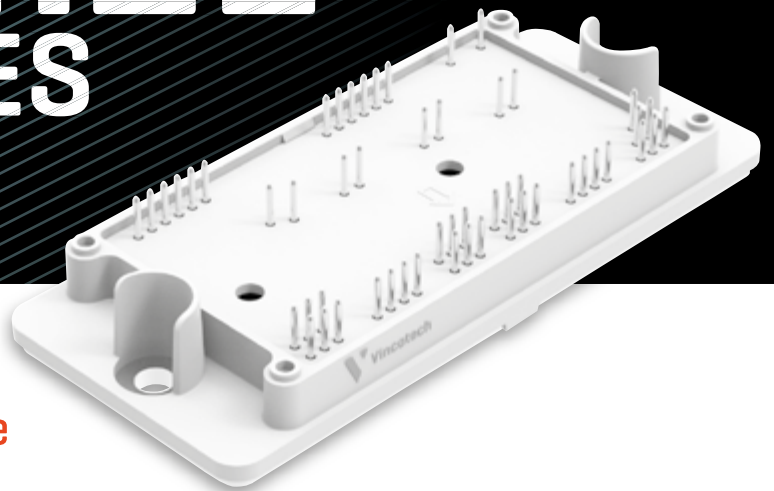
Component design teams can then create very accurate models of magnetic components within the CAD package. They can try-out the impact of different materials, wires and air gaps, tuning the design to get as close as possible to the parameters required by the customer. Using simulation to tune the design allows optimum performance to be achieved without the need to create multiple prototypes.



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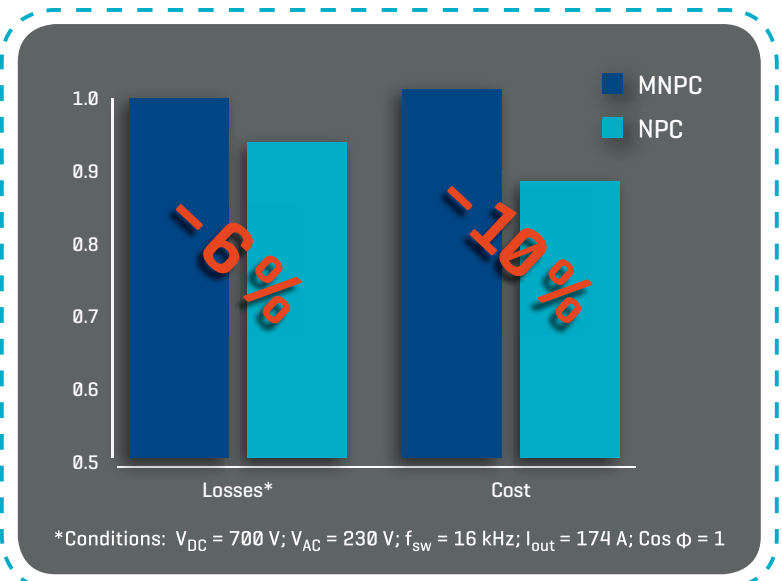


NEW Three-level NPC module up to 120 kVA

With Vincotech's new three-level NPC Inverter, your next Solar, UPS and ESS applications will feature maximum power density and minimum losses. The new *flowNPC 2 S5* module has been targeted to address the key design challenges of high efficiency, low weight and small size. It features the latest generation IGBT technology and supports frequencies up to 50 kHz in a low inductance *flow 2* 13 mm package. The well-known NPC architecture ensures best performance, especially at higher frequencies, and up to 10 % cost saving when compared to other popular three-level architectures such as MNPC.

Main benefits

- / The high power density enables designs up to 120 kVA
- / The fully rated diodes provide full reactive power capability
- / Higher frequencies can be achieved with lower losses
- / Smaller passive components enable lighter designs



With design and analysis based on solid engineering principles and state-of-the-art simulation techniques, designs can push the envelope by integrating new magnetic materials, wires, winding and manufacturing techniques at the earliest possible stage.

Innovative magnetic materials

For the electromagnets used in inductors, transformers, DC-DC converters and the like, designers look for core material that deliver high permeability and maximum flux density. Iron and alloys like SiFe are the traditional starting point.

Ferrites - ceramic, homogeneous materials are composed of various oxides. Those with iron oxide as their main constituent exhibit excellent EMI protection against common mode and differential conducted noise, since their insertion loss is proportional to frequency - thereby showing no attenuation to signals, but high impedance to high frequency noise.

For power conversion applications, working temperature, flux density and frequency are the key parameters to select the proper material: from standard 60 to 100 deg C in handheld converters to -20 to 100 or -60 to 140 deg C for automotive or industrial applications. Converters operate at a wide switching frequency range, depending on voltage, power and cost constraints. Specific materials enable components to operate from just a few kHz through to hundreds of kHz and even MHz, providing high efficiency, compact converters.

Powder cores are distributed air gap cores that are primarily used in power inductor applications, specifically in switched-mode power supply (SMPS) output filters, also known as DC inductors. Other power applications include differential inductors, boost inductors, buck inductors, and flyback transformers.

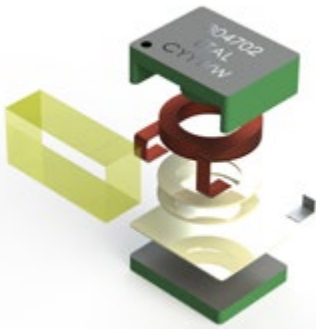


Figure 3: Complete 3D CAD tool suites offer capability to create production level drawings

Different core materials have particular advantages for certain applications. For lowest loss, core loss is the key factor, whilst designs requiring minimum core size, such as a DC bias dominated design, should use materials with highest flux capacity. Saturation is another property to consider, with available materials providing trade-offs between low losses and reasonably high saturation (0.8T) at a low cost, up to higher priced, high saturation material (1.6 T). High saturation is advantageous where inductance under load is critical.

An advance on powder technologies, new amorphous and nanocrystalline magnetic cores allow smaller, lighter and more energy-efficient designs in many high frequency applications for inverters, adjustable speed drives and power supplies. Amorphous metals are produced by using special technology where molten metal is cast into thin solid ribbons. Since the material has no crystalline magnetic anisotropy, amorphous magnetic metal has high permeability.

When compared with conventional crystalline magnetic materials, amorphous magnetic cores have superior magnetic characteristics, such as lower core loss. These cores offer superior design alternatives when used as the core material.

Nanocrystalline alloys offer a unique combination of high permeability with large flux density and low losses at high frequencies. Operational temperatures of up to 180°C are possible. Materials like this enable construction of chokes and transformers in much smaller dimensions than is possible using ferrite based assemblies. Common-Mode chokes, in particular, benefit from the high permeability, because the amount of copper wire can be reduced, thus reducing copper losses and component size.



Figure 4: Advanced design and innovative materials bring new possibilities for custom magnetic components

Why wire is important

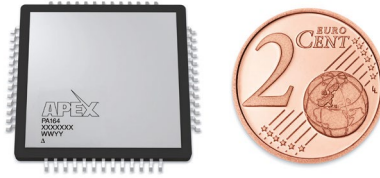
Another development facilitating smaller form factors is the introduction of triple insulated wire. This allows windings to be laid on top of each other, giving mains isolation in a smaller form factor. This technique meets all the leading international safety codes and enables transformers to be manufactured to meet safety isolation standards without the need for margins and tape barriers. With conductor diameters ranging from 0.2 mm to 1 mm, the increased winding space permits smaller transformers to be designed and reduces manufacturing time and cost,

Advances in magnetic materials, wire, winding techniques and equipment, can be fed back rapidly through accurate simulation tool and 3D CAD solutions, to create new optimised solutions across a range of applications, from standard products, through custom designs for signal transformers, LAN & xDSL Modules, Planar Transformers, Inductors and Modules, and CANbus Chokes.

Unsung they may be, but magnetic components help manufacturers to achieve designs that match customers' expectations much more closely, and achieve them more quickly at lower cost.



Andrew Adams, Technical Manager, ETAL Group

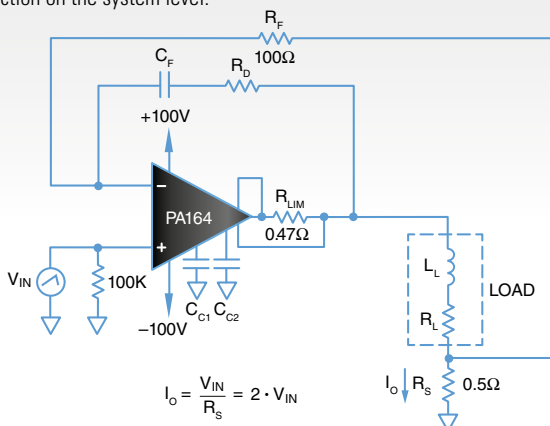


Size Does Matter!

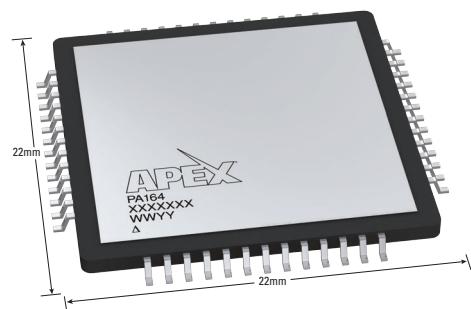
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High Performance Flybuck

A Flybuck is an alternative to a Flyback for low power applications because it is a low-cost, simple to use and isolated topology. Just a synchronous buck and coupled inductor windings are needed to create isolated outputs. Furthermore, a Flybuck typically achieves softer switching compared to a Flyback topology. This can eliminate the need for a snubber circuit and lowers EMI.

By Florian Mueller, Texas Instruments

But how can we improve the performance of a simple Flybuck further? This article presents three different methods which can be used individual or simultaneously. First of all using an inverting topology will influence the duty cycle range and therefore will improve performance and efficiency in many applications. Secondly adding a synchronous rectifier will reduce the secondary side losses and will improve the output voltage regulation. The last method will improve the output voltage regulation further by adding an optocoupler to regulate the output voltage.

Figure 1 shows a simplified schematic of an inverting Flybuck with optocoupler and secondary synchronous rectification.

of leakage inductance, the Flybuck is probably not usable with a duty cycle higher than 60%. Fortunately there is another alternative. An inverting BuckBoost can be used instead of a Buck. This will lead to a lower duty cycle in many applications. Of course it is only practicable if a positive voltage on the primary side is not needed because the BuckBoost is generating a negative primary voltage. Every synchronous Buck controller can be used for realizing an inverting BuckBoost which generates a negative output voltage. It is just a simple trick needed to get the controller working. In a standard Buck the output voltage is connected to the inductor and the return is connected to GND. For an Inverting BuckBoost, simply connect the

is referenced to the negative output. Therefore the maximum VDD voltage seen by the controller is the voltage difference between the input and the output voltage. Please note that the UVLO will not work properly because it is much lower in this configuration.

Secondary Side Synchronous Rectifier

There are different methods to drive secondary side synchronous rectifiers. You can add a separate Gate drive transformer to drive the secondary synchronous FET. If a primary controller is used with external primary Mosfets then the driving signal could be taken from the primary side. Another method is to use a secondary side synchronous controller, which is expensive but typically leads to perfect control of the FET. A simpler and cheaper way than both these methods is to add a gate drive winding to the Flybuck transformer. This "self-driven" technique only costs a few cents, but unfortunately this simple method has a drawback. The timing cannot be controlled perfectly which may result in a short shoot-through current. This will increase the power dissipation and reduce the efficiency. The circuit should be verified in the lab to ensure a safe operation under all conditions. Nevertheless, a self-driven synchronous rectifier will improve the efficiency and the output voltage regulation compared to an output diode. Figure 1 shows the simple circuit of a self-driven synchronous FET (highlighted in brown).

Optocoupler Feedback

In primary side control the secondary output voltage is regulated through the coupling of the primary side voltage. The secondary output is controlled only by the primary output and the transformer. Voltage drops of the output rectifier or parasitic elements like leakage inductance, resistance of the windings, layout or other components cannot be compensated. Therefore typically only an output voltage regulation of about 5% to 10% can be achieved. When better regulation is needed an optocoupler can be used for

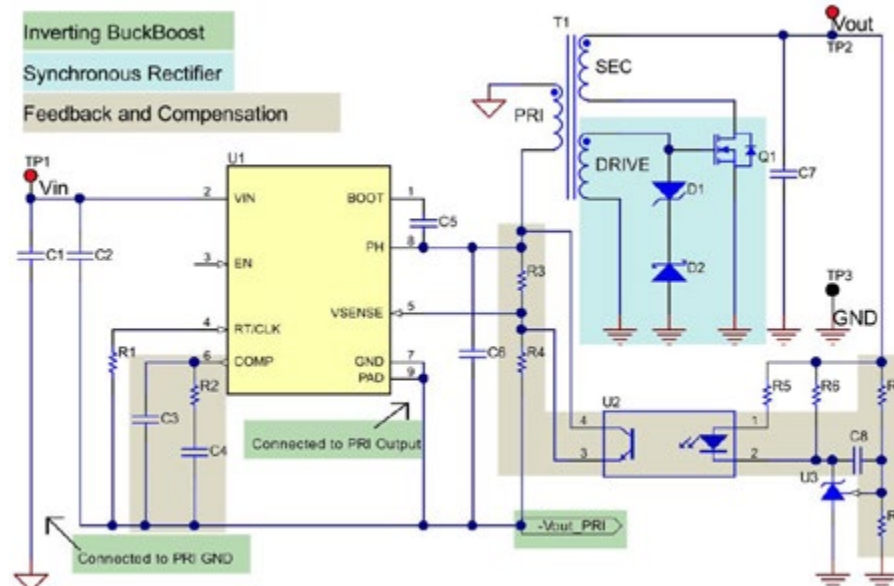


Figure 1: Simplified schematic of a high performance Flybuck

Using an Inverting BuckBoost Topology

In a Flybuck the minimum input voltage must always be higher than the primary output voltage. Very often this results in a high duty cycle for a low input voltage. That is a disadvantage in many Flybuck applications because high duty cycles will increase peak currents a lot. Therefore with large amounts

device ground to the negative output (instead to GND) and connect an additional capacitor between the input and the negative output. (see Figure 1). In this configuration the Buck controller will generate a negative output voltage. Care must be taken about the maximum VDD voltage rating of the controller. After the output is in regulation the controller

regulating the secondary output voltage. How does the regulation of the output voltage work? Figure 1 shows the simplified circuit of an optocoupler regulated design. An error amplifier (U3) such as the TL431 is used together with an optocoupler to provide feedback loop isolation. A small variation of the output voltage due to line or load changes is sensed by the input of the error amplifier and compared to an internal voltage reference. Differences between the divided down output voltage (R7, R8) and the voltage reference are converted into an error current. This error signal is transferred to the primary side through the optocoupler. On the primary side the controller (U1) is regulating the negative primary voltage. Similar to the secondary

tor divider (see Figure 1). The Opto-transistor is in parallel to the high side resistor (R3) therefore the effective resistance can only be decreased. For this reason the primary side resistor divider must be chosen carefully. In order that the secondary loop can control both directions (increasing and decreasing the output voltage) the primary loop itself must regulate a higher primary voltage (absolute value) than required. This means that the primary side voltage divider must be set for a higher absolute value of the negative output voltage. Therefore the secondary loop has the ability to increase and decrease the output voltage which is needed during transients.

A practical example of an inverting Flyback with optocoupler feedback and synchronous rectification is shown in the PMP30197 reference design from Texas Instruments. The peak efficiency is above 92% (see Figure 2) and the load regulation is better than 1.5%. All technical documents such as Schematic, Testreport, BOM or Gerber Files can be downloaded at www.ti.com/tool/pmp30197.

References

Please visit TI's Powerlab reference design library with more than 1500 fully tested power reference designs:
<http://www.ti.com/powerlab>
 Reference Design PMP30197:
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 For more information about power supply technologies and controllers please visit:

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Florian Mueller was born in Rosenheim, Germany, in 1976. He received the degree in electrical engineering from the University of Haag. After working for several years as freelancer in the field of electrical engineering, he joined TI in 2011 and is working in the European Power Design Services Group, based in Freising, Germany. His design activity includes isolated and non-isolated DC/DC and AC/DC converters for all application segments.

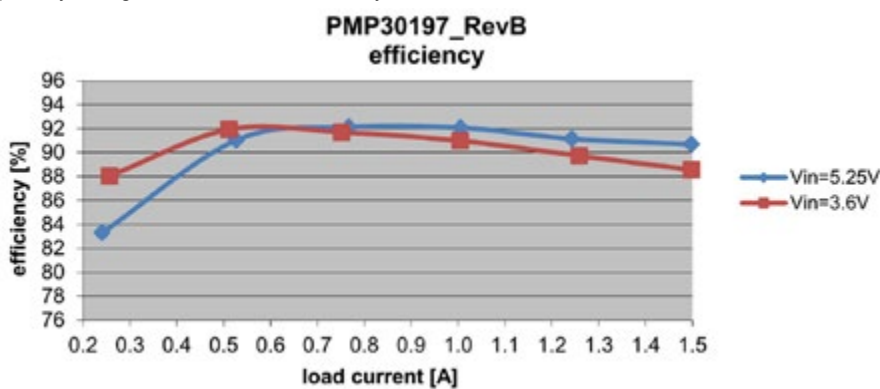


Figure 2: Efficiency Reference Design PMP30197

side, a resistor divider (R3, R4) is used to measure and compare the output voltage with the internal voltage reference of the controller. In other words, there are two feedback paths, one on the primary side and one on the secondary side. Combining these two feedback paths is simply done by connecting the Opto-transistor to the primary side resis-

Conclusion

The Flyback topology has become more and more popular in recent years. Particularly in applications with a wide input voltage range or a wide power level range, the performance of a Flyback is sometimes not sufficient. The presented methods showed ways to improve the behavior of this isolated topology.

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IGBT Modules Sectioned Non-Destructively

Non-destructive sectioning of solid samples is performed by acoustic micro imaging tools, which are sometimes still referred to by their old name of acoustic microscopes. As in physical sectioning of a part or assembly, the resulting image shows a side view of interior details. Linear measurements within the acoustic image are accurate. Non-destructive acoustic sectioning was developed by Sonoscan as an analytical method, and given the name Q-BAM™

By Tom Adams, consultant, Sonoscan, Inc.

Acoustic micro imaging tools use a scanning transducer that pulses ultrasound into the sample and receives the return echoes, which come only from interfaces between materials. The transducer can move laterally at more than 1 m/s, and is coupled to the sample's surface by a column of water (ultrasound does not travel through air). The speed of ultrasound through most production materials means that the transducer can launch and receive several thousand pulse/echo events per second while scanning. The time for a single launch-receive event is on the order of several microseconds.

The tools typically make topside images of x-y area of a sample at a desired depth - for example, the underfill depth in a flip chip. This is known as C-mode imaging. The selected depth is typically less than the whole thickness of the sample, although in multi-layer ceramic chip capacitors nearly the whole depth may be selected (the term is "gated") because of the homogeneity of the capacitor's structure. Scanning for any sample proceeds by rows and columns until the entire desired area has been scanned and imaged. The resulting acoustic image may have thousands or millions of pixels, one for each pulse/echo set.

Q-BAM imaging differs in that the transducer scans only along a single straight line, which may have been selected because a C-mode image of the part suggested that a particular vertical plane might be profitably imaged. So imaging proceeds along a single row or column, although the row or column need not be parallel to any side of the part. In the first scan along the selected line, echoes are collected only from the deepest part of the vertical plane below the line. Each successive scan collects echoes from a slightly higher depth having the same z-dimension. Some depths, of course, will contain no material interfaces. When the top surface of the part is reached, data has been collected to make a dimensionally accurate image of the vertical plane. A non-destructive cross-section has been created.

An operator can make as many Q-BAM images of a part under examination as he wishes because there is no physical disruption of the part. Very thin gaps or cracks, which might be filled in and missed during physical sectioning, will be visible because the solid-to-air interface that they present reflects very nearly 100% of the ultrasonic pulse. When acoustic imaging is completed and has revealed the internal structure, Destructive Physical Analysis can be used, but it has now become Acoustically Guided Destructive Physical Analysis.

In imaging IGBT modules, the tool's transducer scans the bottom side of the base plate. The tool uses an inverted transducer and water jet which are positioned below the IGBT module. Most IGBT modules cannot be imaged from the top side because the power load in these switches is typically so high that even the slightest solid residue left on the die by the water couplant would cause a short circuit. So the ultrasound is inserted into the base plate at the bottom of the module. From there it typically passes through the solder layer, the ceramic raft, the substrate and reaches the die; the reflected ultrasound is collected by the transducer below the base plate. Despite the number of material layers, it is generally possible to image voids in the die attach layer.

Common defects in IGBT modules include voids or non-bonds in the solder bonding the base plate to the ceramic raft above; warpage or tilting of the raft, and voids in the die attach material. Voids and non-bonds block heat flow from the die to the heat sink. Because thermal dissipation in IGBT modules is so critical, it is important to measure from the acoustic data the collective area of these defects to avoid overheating of the die and field failure. Tilted and warped rafts can also cause overheating, not by blocking heat flow but by creating internal stresses in the die.

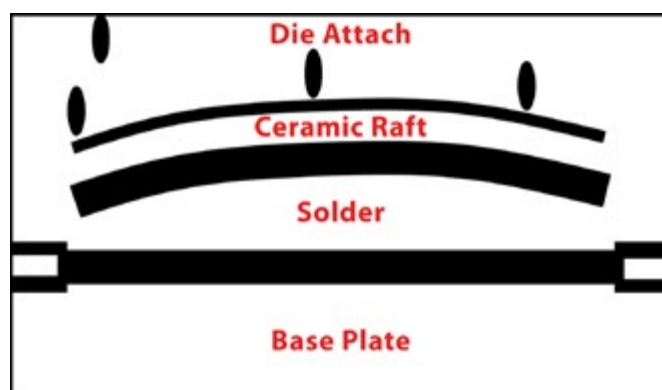
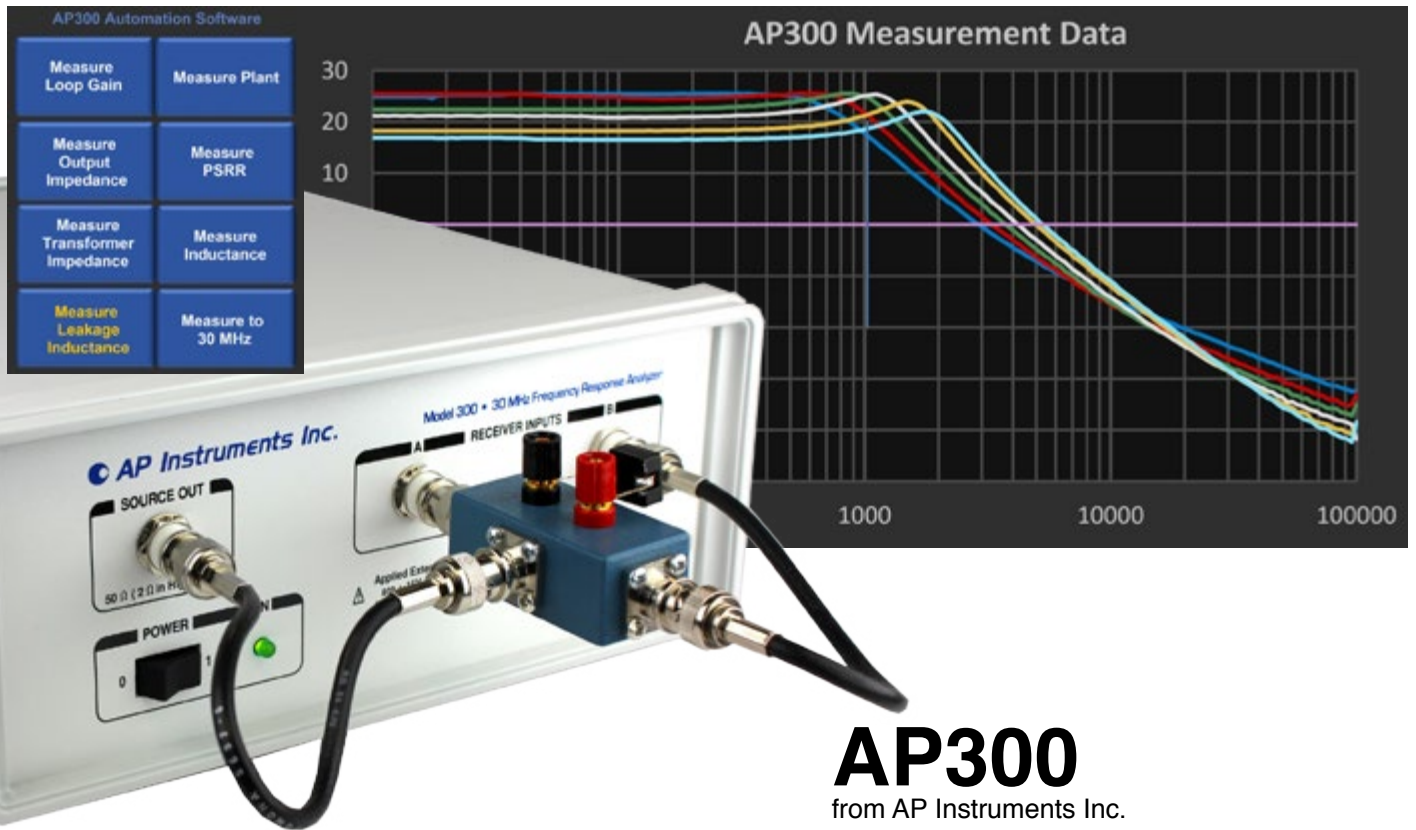


Figure 1: Diagrammatic representation of the interfaces in Figure 2.

The diagram in Figure 1 shows the basic side-view structure of the IGBT module illustrated by the Q-BAM image in Figure 2. The baseplate is typically featureless. The solder joining the base plate to the raft often contains voids or non-bonds - so often that some module makers inspect acoustically only for solder layer defects. The ceramic rafts in the modules shown here are domed, but rafts in general may be dishd,



AP300

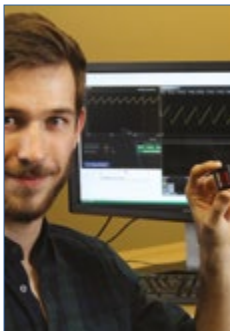
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irregularly warped, or tilted. Voids in the die attach block heat flow from the die. Warping or tilting of the die do not block heat flow, but they can cause hot spots on the die. Although IGBT modules can be imaged acoustically after encapsulation, they are far more often imaged before encapsulation to permit those modules with internal defects to be reworked or to be discarded before more money is spent on them.

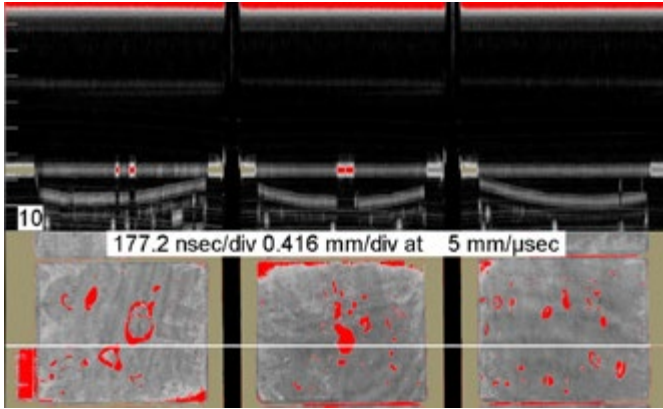


Figure 2: Bottom: Top-down acoustic view. Top: acoustic section along the white line in bottom image. Note warped rafts.

Figure 2 shows, in the bottom section, the down-looking reflection mode image of three of the nine populated rafts in an IGBT module. The top portion of the Figure shows the Q-BAM side view as it looked when the transducer scanned back and forth along the white line drawn horizontally through the reflection mode image.

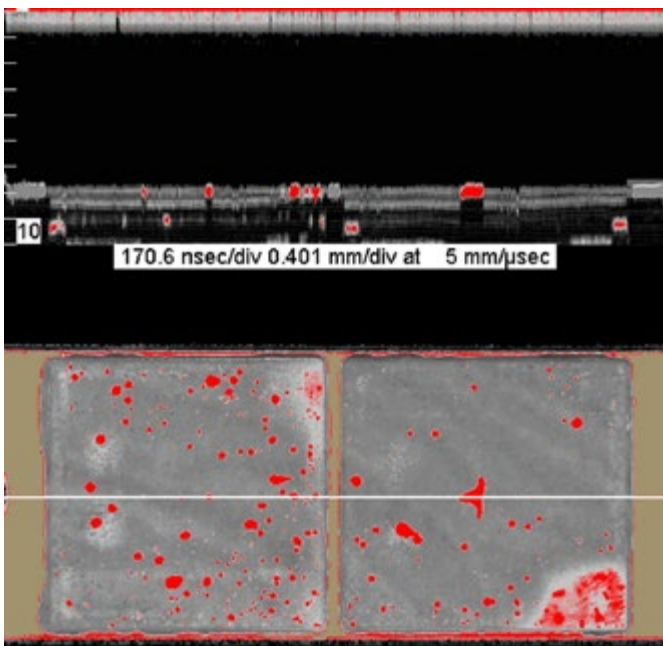


Figure 3: The two gray lines are the bottom the base plate and the top the raft. The solder layer here is very thin

Red features in the reflection mode image are gap-type defects whose solid-to-air interface reflects virtually all of the ultrasound striking it. The white label informs the viewer that the white lines at the upper left edge of the image are 0.416mm apart.

In the Q-BAM image at top, it can be seen that the three red voids through which the white line passes are located vertically between the base plate and the solder. The interfaces between the solder and the rafts, though, are curved. The solder-to-raft inter-

faces are clearly visible. The interface between the bottom of the raft and the die attach material below it is fainter, but present. The interface between the raft at center and the solder above it appears interrupted near its center. The short “missing” section is missing because the void directly above it reflected all of the ultrasound back to the transducer and none reached the raft surface here. The raft at left has two such interruptions, each caused by a void above.

The image in Figure 3, although from the same module, presents a different situation. In the reflection image at bottom, there are numerous voids, some of which are concentrated in regions where there are pale gray regions that seem to relate to the solder.

A glance at the Q-BAM image shows that the vertical distance between the base and the raft - i.e., the solder thickness - is very small. There are nevertheless several voids in the solder along the horizontal line drawn for the Q-BAM image. The thickness of the solder is especially small at the right end. Overall, though, these rafts appear to be relatively flat, unlike those in Figure 2. And there are several pale gray regions in the otherwise darker gray representing the solder-to-raft interface.

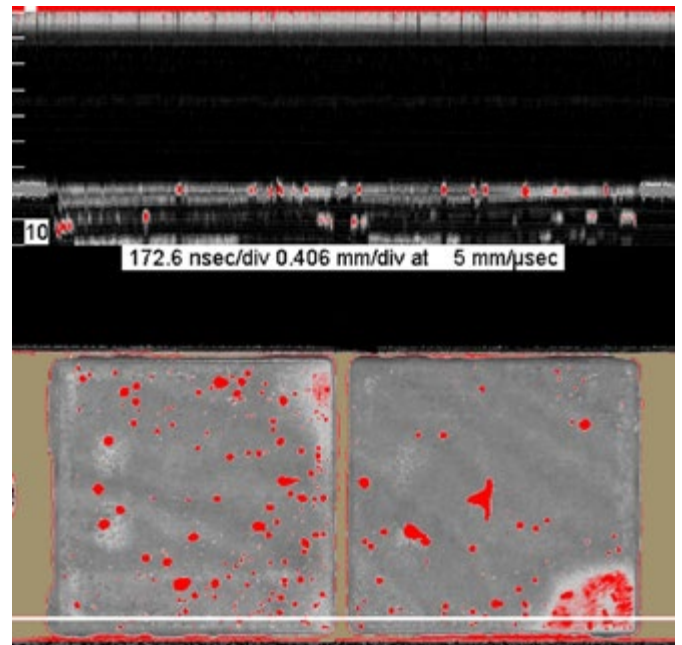


Figure 4: Sectioning through a gray region near the edge of the assembly reveals a lack of solder but many voids.

Moving the Q-BAM line so that it intercepts the large gray area at lower right (Figure 4) shows what has happened. Two two interfaces above and below the solder layer actually merge at the right end of this Q-BAM image. That means that there is almost no solder between the base plate and the raft. The bottom of the raft is represented not by a solid gray line but by a horizontal row of about a dozen voids extending across the width of both rafts. Features below this row are in the die attach. The Q-BAM imaging mode lets the user see what he would see by physically cutting and polishing an IGBT module. The dimensions of the features are accurate, and the tool operator can make as many images in as many locations on the module as he likes. The impact on both process control and field performance is likely to be very positive.

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DC/DC Railway Converters with ultra-wide Input Range

When planning a universally applicable railway device typically at least three versions of the same design are necessary to cover all



standard supply voltages in railway vehicles ranging from a nominal 24VDC to 110VDC. This causes additional complications, which can be avoided by using Recom's newly developed DC/DC railway converters with ultra-wide input voltage, which allow for all-in-one solutions.

The half-brick DC/DC converters RPA100H and RPA200H series are designed for railway rolling stock and high voltage battery applications. By accepting a 10:1 input voltage from 14.4VDC to 156VDC, these converters can be considered for any railway design without worrying about voltage tolerances, voltage dips or the local supply voltage. Their ultra-wide input voltage range covers all input voltages from nominal 24VDC up to 110VDC (including EN50155 transients and brownouts) in a single product and they offer isolated and regulated 12V or 24VDC outputs. The converters have a consistently high efficiency over the entire input voltage and load range, and come with a metal baseplate to permit a wide operating temperature range from -40°C up to +97°C (when suitably cooled).

www.recom-power.com

Teledyne LeCroy launches 24-Bit Sensor Acquisition Modules



The SAM40 provides up to 24 input channels for low frequency (sensor signal) acquisition and analysis. It connects to a 4 or 8 channel Teledyne LeCroy 12-bit resolution high definition oscilloscope (HD4096 HDOs and MDAs) to provide Analog+Digital+Sensor (up to 8+16+24 channel) acquisitions. This capability is ideal for system debug and analysis of deeply embedded, electromechanical, and mechatronic designs in the medical, mil/aero, motors and drives, power, appliance, Internet of Things (IoT), vehicle/automotive and other applications. All channels have 24-bit resolution (stored in 32-bit floating point format) with ~0.05% total accuracy. Built-in filters with settings as low as 100 Hz further reduce noise. Adjustable gain ranges (1 mV to 10 V/div) accurately acquire a wide range of signal levels. The SAM40 simply connects to the supported Teledyne LeCroy oscilloscope with a USB2.0 cable for data transfer and control/trigger commands, and BNC cables for clock/timebase synchronization. No programming or complex setups are required.

www.teledynelecroy.com

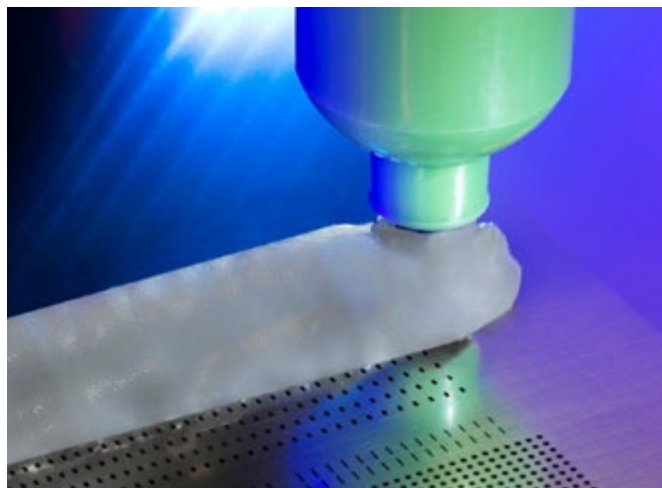
Heraeus Electronics introduces no-clean Solder Pastes

Heraeus Electronics is expanding its range of no-clean soldering pastes with a low melting point. The new F498 product series allows significant cost savings in the soldering process.

The new series of soldering pastes is characterized by a low void rate and outstanding wetting properties on a wide range of different surfaces. This reduces the formation of solder balls (mid-chip balling). The lower temperature in the reflow process reduces energy consumption, saving energy costs. Low-melting soldering pastes use up to 40 percent less energy, resulting in a corresponding reduction in carbon emissions. Longer cleaning intervals due to the lower temperatures reduce maintenance costs.

There are also other advantages related to the lower temperatures for soldering processes: Up until now, components and circuit boards were subjected to temperatures of around 250°C when using traditional lead-free soldering pastes.

www.heraeus.com/en/group/home/home.aspx



Calibration Instrument reduces Cost and Complexity

The Yokogawa LS3300 is a new dedicated, stand-alone and cost-effective calibrator that is designed to reduce the cost and complexity of calibrating power meters and analysers with accuracies up to 0.15%. Unlike existing multi-function calibrators, the LS3300 provides a lower cost and easy-to-use solution with specific features for calibrating power meters.



“Yokogawa is a world market leader and a leading authority on power measurement with a long history in AC and DC calibrators”, says Terry Marrinan, Vice-President, T&M Business Unit, Yokogawa T&M Europe and Asia Pacific: “Now, with the launch of the LS3300, we are bringing new dimensions of cost-effectiveness and simplicity to those who need to undertake their own calibration operations on multiple instruments with low to medium accuracies.”

The LR3300 combines a wide output (up to 1250 V and 62.5 A) with high accuracy (450 ppm or 0.045%) and high stability (100 ppm or 0.01% for one hour). For larger current outputs, up to 180 A can be obtained by synchronising the outputs of multiple units.

www.tmi.yokogawa.com

Silergy Expands Embedded Measurement Processor Portfolio

The new SY7T609 enables feature rich energy measurement and power quality analysis in cost sensitive IoT applications such as smart-plugs, power-strips, intelligent lighting and other points of load. Available in a 14-pin package, the device features a 24-bit processor core for signal processing, integrated flash memory, a 22-bit Delta Sigma converter with programmable gain amplifiers, communication interfaces and digital I/O's.

The SY7T609 comes pre-loaded with firmware providing a complete solution including signal processing, configurable alarms and calibration routines.

The flexible serial communication interface (UART, I2C and SPI) enable easy system integration. Configurable digital I/O's can alert the host of fault conditions or be controlled as digital input or output. Intelligent programmable control of latched/non-latched relays is also available which can be synchronized to the Zero Crossing of either Voltage or Current.

www.silergy.com/productsview/SY7T609+S1

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Former manager of R & D / managing director in D, USA, NL,A.
Consultant and owner of an electronics design lab since 23 yrs.
140 publications resp. patent applications, inventor of
the current-mode control in SMPS (US Patent 3,742,371).
Names and business affairs of clients are kept strictly confidential.

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Compact 5W AC/DC Converters From Recom Power

Dengrove Electronic Components has the perfect power supplies for small IoT devices and industrial controls, with the launch of the Recom RAC05-K series of highly integrated 5-Watt AC/DC converters. Housed in a 25.4mm x 25.4mm fully encapsulated lightweight plastic case, and with important features such as short-circuit and



over-voltage protection built in, RAC05-K modules can fit within tight spaces. They also meet EN55032 class-B specifications without requiring external filtering components. The modules are built to withstand harsh industrial or outdoor environments, and can operate from -25°C up to 50°C at full load, or 70°C with derating. With very low no-load consumption of 75mW, and high light-load efficiency, the RAC05-K series is ideal for powering devices like wireless sensors or communication modules that are always on, with short periods of peak activity. Available with a single output voltage of 3.3V, 5V, 12V, 15V or 24V, they can also be used to operate relays, data gateways, or building-automation nodes. The modules feature a 60ms hold-up time at 230VAC input, to maintain a stable output even if the AC-line quality varies.

The RAC05-K series is fully certified to UL/IEC/EN60950-1 and UL/IEC/EN62368-1 with CB reports, CE marked, and covered by a three-year manufacturer's warranty.

www.dengrove.com

Methode Introduces the MDUAL™ Power Connector

Methode Power Solutions Group announces the MDUAL™ two-position, high-power, blind mate connectors with halogen-free housings conforming to RoHS-3. The MDUAL comes in three pin sizes,



6.4mm, 9.1mm and 12.7 mm with current capability up to 265A. The self-aligning housings enable blind mating and include a polarity key. The patented PowerBud technology lowers both contact resistance and contact normal force without increasing connector size. In addition, MDUAL connectors typically withstand 10,000 mating-unmating cycles without performance degradation, far exceeding the capability of similar competitive connectors. The halogen-free plastic housings are RoHS 3 compliant, which can eliminate the need for user's future material changes or validation testing. Samples are available.

The PowerBud technology was originally pioneered by a Massachusetts Institute of Technology (MIT) professor and graduate students investigating tribology, the science and technology of interacting surfaces in relative motion, including friction, lubrication and wear. The researchers developed a prototype power connector with massively parallel points of contact which exhibited superior qualities compared to conventional, commercial power connectors. Their connector had very low contact resistance as well as very low insertion force without a commensurate connector volume increase.

www.methode.com

Alpha Assembly Solutions Launches Liquid Flux Selector Tool

Alpha Assembly Solutions has launched a web-based tool that allows users to find the most suitable flux for wave soldering, selective soldering or photovoltaic applications.

The tool is accessible through AlphaAssembly.com located under "Site Tools" and can be utilized based on alloys, application method, process and electrical requirements and even preferred flux solvent. Additional parameters can also be selected to further refine search results that align with your electronics manufacturing process.

"Alpha offers state-of-the-art and comprehensive flux selections for electronics assembly and is one of the first companies who introduces thick board flux and halogen-free flux that offers high reliability and excellent soldering performance for the critical wave soldering process", said Bernice Chung, Global Portfolio Manager for Wave Soldering at Alpha, a part of the MacDermid Performance Solutions group of businesses. "Flux plays a critical role in the circuit assembly process and it is essential for manufacturers to pair the right solder



with the right flux to maintain the integrity of any soldered connection and ensure the production of high quality boards."

www.alphaassembly.com

600 V CoolMOS™ Pushes the Performance Boundary



Infineon Technologies AG released the latest high-voltage Superjunction MOSFET technology, the 600 V CoolMOS™ CFD7 completing the CoolMOS 7 series. This MOSFET addresses the high power SMPS market for resonant topologies. It offers industry-leading efficiency and reliability in soft switching topologies like LLC and ZVS PSFB. This makes it a perfect fit for high power SMPS applications such as Servers, Telecom equipment power, and EV charging stations.

The 600 V CoolMOS CFD7 succeeds the CoolMOS CFD2. The new MOSFET is up to 1.45 percent more efficient than its predecessor or competitor offerings. It combines all of the advantages of a fast switching technology with high commutation ruggedness, without impacting the easy implementation in the design-in process. The 600 V CoolMOS CFD7 features reduced gate charge (Q_g) and improved turn-off behavior. Additionally, it has a reverse recovery charge (Q_{rr}), which is up to 69 percent lower than competing products in the marketplace. The 600 V CoolMOS CFD7 provides industry-leading solutions for THD and SMD devices, which supports high power density solutions.

www.infineon.com/cfd7

IXYS Introduces New 4.5kV High di/dt Fast Recovery Diode

IXYS Corporation announced that its UK subsidiary introduced a new addition to its family of 4.5kV fast recovery diodes (HP-sonic FRD) with a very high rate of change of current capability and soft recovery characteristics. The new diode has a nominal operating current of 460 amperes and is optimised to be used in conjunction with IXYS UK's extensive range of press-pack IGBTs. The new diodes incorporate IXYS UK's most advanced process and assembly technology, replacing older designs based on floating silicon. The new bonded die design offers a diode with improved thermal stability and very robust mechanical properties. The silicon is optimised with advanced

processing to give unrivalled di/dt, change of current capability, more than 2kA per microsecond, while retaining a soft recovery characteristic and low switching losses. The diodes are packaged in fully hermetic 26mm thick ceramic packages with copper electrodes and are compatible for series clamping in the same stack as IXYS UK's range of very high current press-pack IGBTs. The 460 ampere device has a 43mm die and is packaged in a 38mm electrode package with an overall diameter of 60mm.

www.ixysuk.com

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ON Semi's Flexible RSL10 SoC, Now Shipping from Mouser, Ideal for IoT and Connected Health Wearables

Mouser Electronics, Inc. is now stocking the RSL10 multi-protocol system-on-chip (SoC) from ON Semiconductor. Offering ultra-low-power wireless connectivity for a broad range of applications, the versatile Bluetooth® 5-certified SoC supports Bluetooth low energy



technology as well as 2.4 GHz proprietary or custom protocol stacks. The ON Semiconductor RSL10 SoC, available from Mouser Electronics, features a 48 MHz Arm® Cortex®-M3 processor bolstered by a 32-bit dual-Harvard DSP core that supports the audio codecs necessary for wireless audio communication. Including both flash and RAM, the device's diverse memory architecture enables storage of the Bluetooth stack, as well as other applications. The highly integrated RSL10 SoC includes a DMA controller, oscillators, and ultra-efficient power management units. The SoC is designed for use in applications with 1.2V and 1.5V batteries and supports a supply voltage range of 1.1 to 3.6 V without the need for an external DC/DC converter. The SoC is supported by the RSL10 Evaluation Board, which provides access to all input and output connections through standard 0.1-inch headers. Additionally, the evaluation board offers an onboard communication interface circuit and a J-Link solution to enable users to debug the board through a USB/PC connection.

www.mouser.com/onsemi-rsl10

Artesyn Announces 800 Watt CRPS Server Power Supply

The CSU800AP is housed in a compact 1U high enclosure measuring just 2.89 x 7.28 inches (73.5 x 185.0 mm) – a significantly smaller footprint than that of similarly rated earlier generation power supplies – achieved by using the latest power switching technology and high density component packaging techniques. This power supply features a wide input range of 90-264 Vac, active power factor correction and is certified for 80plus platinum rated efficiency peaking at 94 percent. It also features improved current harmonics (iTHD) at light loads. The CSU800AP generates a main output of 12 Vdc for feeding downstream dc-dc converters in systems using distributed power architectures. A 12 Vdc standby output rated at 3 A can be used for power management or supervisory circuitry. The main DC output of the CSU800AP can deliver up to 66.7 A continuously and with peak-pulsed capability of up to 93.3 A. Active current sharing helps maximize cost effectiveness by eliminating the need for additional



components when paralleling multiple power supplies for high current applications.

www.artesyn.com

Nexperia introduces In-Vehicle Network Protection Diodes



Drop-in replacements have higher surge current, greater ESD robustness and much better ESD clamping

Nexperia, the former Standard Products division of NXP, announced a new generation of in-vehicle network (IVN) protection diodes that offer a higher surge current, greater ESD robustness and a significant improvement in ESD clamping performance. The new AEC-Q101 qualified PESDxIVN series of surface mount devices is optimized for the latest generation of CAN, LIN, and FlexRay transceivers.

The new parts are drop-in replacement for legacy devices, available in familiar SOT23, SOD323 and SOT323 packages. However the new parts deliver higher performance. For example, PESD2IVN24-T parts deliver a 30 kV ESD robustness (up from 23 kV on the legacy PESD-1CAN), an improved surge current of 3.5 A and much better clamping of 42 V at 3.5 A (was 70 V at 3 A). Other parameters remain constant or slightly better. The PESD1IVN27-A offers the same improvement in ESD robustness with a lower (=better) clamping voltage compared to the legacy PESD1LIN.

www.nexperia.com

Push-button Load Switch with Power Save Function

Torex Semiconductor Ltd has launched a series of push-button load switch ICs for devices with small-capacity batteries. These ICs enable a significant reduction of power consumption during standby periods after shipping and while the power is turned off, and allow shutdown



of the power supply in the event the system freezes. The demand for miniaturization of battery-equipped devices is increasing as the use of wearable devices and IoT devices has spread in recent years. Along with miniaturization, there is a critical need for power saving, and lengthening battery life is also an issue in device development.

The push-button load switch ICs launched by Torex can make a significant contribution to resolving the issues of device miniaturization, saving power, and lengthening battery life.

Methods available for turning off the main power in order to save energy include device power saving using the microcontroller's Deep Sleep Mode, and creating a power on/off switch using the microcontroller and external components (discretes). These new ICs enable on/off control of the power line by the IC itself with no need for external components. In addition, by shutting down (off) the power line of battery-equipped devices after shipping testing, a significant reduction of power consumption during long-term storage of the devices is now possible. Quiescent current while the power is off is very low, only 10nA (TYP.).

www.torexsemi.com

Hioki Launches New Memory HiCorder

Hioki is pleased to announce the launch of its flagship memory recorder, the Memory HiCorder MR6000. The MR6000 delivers high-speed isolated measurement at 200 MS/s and rapid, real-time saving of measurement data that is 32 times faster than any previous model. The 200MS/s sampling speed is supported by the new U8976 High-Speed Analog Unit, enabling it capture minutely detailed waveform changes, which is critical for applications such as motor and inverter performance testing. Another improved feature is the high-speed, real-time saving of measurement data, up to a 1MS/s transfer rate for all 32 channels for one hour, to the new SSD Unit U8332. Other key features include the Memory HiCorder Concierge, an automatic waveform search function that speeds up the identification of user-specified waveforms in order to improve R&D efficiency. The MR6000 also features a 12.1-inch touchscreen, which makes settings configurations and waveform searches even more intuitive.

www.hioki.com



HiPak

The solution for your demanding applications.

ABB Semiconductors' HiPak modules are a family of high-power IGBTs in industry standard housings using the popular 190 x 140 mm, 130 x 140 mm and 140 x 70 mm footprints. HiPak modules are the perfect match for demanding high-power applications such as traction, transmission & distribution, renewable energy (wind, solar) and industrial drives.

abb.com/semiconductors

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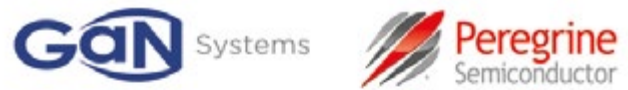
Full-bridge Evaluation Board for High-frequency Switching and Class D Amplifiers

Richardson RFPD, Inc. announced the availability and full design support capabilities for a new evaluation board from GaN Systems Inc. and Peregrine Semiconductor Corporation.

The GS61004B-EVBCD evaluation board combines GaN Systems' GaN E-HEMT with the ultra-fast PE29102 gate driver from Peregrine. Using this evaluation platform, designers can characterize the performance advantages that result from operating a Class D amplifier at a high switching frequency. Low dead time and sub-nanosecond turn-on/off yield a higher-efficiency design with less total harmonic distortion and EMI.

Additional key features of the GS61004B-EVBCD include:

- Full-bridge with four GaN E-HEMTs and two E-HEMT drivers
- GS61004B E-HEMT operable up to 100 MHz
- PE29102 E-HEMT driver operable up to 40 MHz
- Best-in-class propagation delay: 10–45 ns, depending on configuration
- Optimized, Vcc independent, for matched dead time
- Integrated, resistor-adjustable dead-time control
- Control pins to evaluate phasing of each half-bridge circuit
- Snubbers from each switch node to ground



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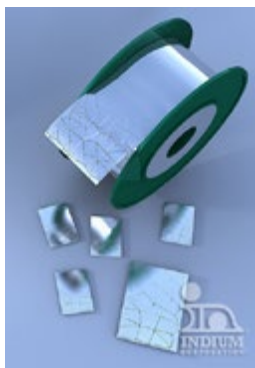
www.richardsonrfpd.com

Indium Features InFORMS® Reinforced Solder Ribbon

Indium will feature its reinforced solder alloy fabrications, InFORMS®, at NEPCON Japan 2018 in Tokyo. The Corporation is redefining solder with its patent-pending InFORMS solder ribbon for automated assembly. InFORMS solder ribbon is a composite fabrication consisting of solder and a reinforcing matrix that:

- Increases lateral strength
- Maintains bondline co-planarity
- Improves thermal cycling reliability

www.indium.com/inform



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- Intuitive operability with 12.1-inch touch screen

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DC UPS systems with SuperCaps as Energy Storage

With two new DC UPS systems, Bicker Elektronik, Donauwoerth/Germany, offers a particularly innovative and economical solution for the uninterrupted power supply of DC loads, such as motors, sensors, actuators or card readers. The two DC UPS modules UPSIC-1205 (12 VDC / 5A) and UPSIC-2403 (24 VDC / 3A) are equipped with ultracapacitors (so-called SuperCaps) as energy storage which operate according to the principle of double-layer capacitors (EDLC). The DC UPS systems protect against voltage fluctuations, flicker, voltage drops or failures of the supply voltage. Unlike batteries that store energy through a chemical reaction, SuperCaps are based on electrophysical



principles and are ready for operation within a very short time. They operate in a wide

temperature range and are characterized by their high current-carrying capacity, their power density and their reliability. Due to the high cycle stability (> 500,000 charging and discharging cycles), the new SuperCap UPS solutions from Bicker Elektronik have a particularly long service life and are practically maintenance-free. This means an increase in long-term availability while minimizing the maintenance effort of the supplied system. Due to the compact dimensions, a high power density and the corresponding interface configuration, the integration into a wide range of sensitive applications is possible.

www.bicker.de

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abb.com/semiconductors

ABB



Why trade performance for isolation?

TRENCHSTOP™ advanced isolation overcomes the limitations of traditional packaging and isolation techniques. Mounted directly on the heatsink with a fast and simple, one-step assembly process, it provides 100%, fully tested isolation. By eliminating the need for thermal isolation foils, fragile ceramic plates and thermal grease, this solution accelerates assembly times by up to 30%.

Features

TRENCHSTOP™ advanced isolation features H3 technology for outstanding electrical and thermal performance:

- › 0.2% more efficient at low load in PFC applications
- › Only 38pF coupling capacitance
- › Runs at least 10°C cooler than TO-247 FullPak

Benefits

TRENCHSTOP™ advanced isolation further improves manufacturing processes and product reliability:

- › Up to 35% reduction in assembly costs
- › Complete control over assembly process and improved yields
- › Increased reliability due to uniform $R_{th(jh)}$ distribution